

## Feline Symposium

The 21st Annual Feline Symposium was held on Saturday, April 4, 1998. In light of the enormous emotional investment owners make in their feline companions, the seminar focused on the strong symbiosis between cats and people, as well as the critical care and preventive measures designed ultimately to prolong that bond. The 22nd Annual Feline Symposium will be held on March 6, 1999.

### History of the Cat

The unprecedented popularity felids today enjoy as companion animals is the latest phase in a centuries-old love-hate relationship with mankind. Dr. James A. Serpell, Marie A. Moore Associate Professor of Humane Ethics and Animal Welfare at the School, chronicled the domestication of cats throughout the millennia.

Archaeological, genetic and behavioral evidence suggest that the domestic cat (*Felis catus*) is descended from the African wildcat (*Felis libyca*). There are also etymological reasons for this assertion: The English word "cat," the French "chat," the German "katze," the fourth-century Latin "cattus" and the modern Arabic "quttah" likely derive from the Nubian word for cat — "kadiz."

The oldest known bony remains of African wildcats date back to 6000-7000 B.C. They were excavated from Jericho, and from Cyprus where they coincide with the earliest human settlements on this Mediterranean island. Whether these early cats were domesticated, however, is unclear, said Dr. Serpell. The prevailing theory is that cats likely achieved domestic status in Egypt sometime during the third millennium B.C. Egyptian iconography from 1600 B.C. and onward frequently portrays cats in domestic vignettes; cats were illustrated sitting under their owners' chairs, playing with other animals and even helping people to hunt birds among the papyrus swamps of the Nile delta.

How did cats slink so gracefully into the company of humans? "The process that led to the cat's domestication is shrouded in a certain amount of mystery," said Dr. Serpell. Experts believe a mutualistic association based on the need for rodent control in early Egyptian settlements — which thrived on grain cultivation and storage — was responsible.

Much like the celestial ascent of cows in India, domesticity led to divine worship for cats. Deities with feline heads and human bodies populated Egyptian spiritual imagery. The cat was linked to the mother goddess Isis and to the goddess Bastet, who symbolized fertility, fecundity and motherhood. According to ancient writings, the temple built in deference to Bastet was inhabited by thousands of cats who were fed and cared for by the priesthood.

So deified were cats in ancient Egypt that the death of one sent its human family into a state of mourning manifested by shaved eyebrows as a sign of respect. The dead cat was embalmed and buried in a sacred repository, provided adequate funds were available. Owing to their status as a protected species in Egypt, causing the death of a cat — even accidentally — was a capital offense. The Egyptians restricted the export of cats, thereby retarding their spread to neighboring Mediterranean countries.

The earliest known representation of cats in Greece is on a marble block dating back to about 500 B.C. At the time, cats were regarded as novelties in Greece and Italy, where rodent control was relegated to ferrets. The earliest reference to cats in India dates back to about 200 B.C., and cats probably colonized the Orient soon thereafter. The Romans propagated the spread of the domestic cat — which owes much of its colonizing ability to its facile adjustment to shipboard life — to northern Europe and other outposts of the Roman Empire; by about the middle of the fourth century A.D., domestic cats were present in Britain.

Modern studies have concluded that

current gene frequencies for feline coat color variation throughout the world correspond to early colonization patterns. For example, the sex-linked, orange coat-color mutant, which appears to have originated in Asia Minor, is today quite prevalent throughout the Near East, northern Africa, southern Italy, Germany, France, northern England and Scandinavia. This, said Dr. Serpell, may reflect the movement of cats on Viking trade ships in the eighth and ninth centuries A.D.

By about 1200 A.D., the cat experienced a calamitous change in fortune. "The gradual extinction of pagan gods and goddesses and the rise and spread of Christianity produced very dramatic changes in attitudes to cats throughout Europe," Dr. Serpell explained. Cats were rapidly transformed from benevolent symbols of femininity to malevolent agents of the devil. At the time, nearly all the major heretical sects were accused of worshiping the devil in the form of a black cat. Up until the eighteenth century, cats were caught up in the wave of persecution of witches, of whom cats were viewed as demonic companions. On feast days throughout Europe, cats were captured and tortured to death as symbolic means of driving out the devil.

"By associating the cat with the devil and bad luck," Dr. Serpell alleged, "the Church provided the superstitious masses of Europe with a kind of universal scapegoat, something they could blame for all the hardships of life."

The metaphoric link between cats and women, particularly the threatening aspects of female sexuality, was also responsible for this rancor toward cats. Dr. Serpell referred to monstrous vampire cats of Japanese folklore that assumed the forms of women in order to "suck the blood and vitality from unsuspecting men."

This malice did not forestall the spread of cats to virtually every corner of the world. In 1986, the cat overtook the dog as the most popular companion animal. Today, the cat's popularity is unprecedented, comparable only with



its heyday in ancient Egypt. Yet it is a wavering acceptance. In a modern survey of American attitudes toward cats, 17.4 percent of respondents expressed some animosity toward cats (versus 2.6 percent who reported disliking dogs).

Over the years, cats have aroused antipathy due likely to their somewhat ambivalent relationships with people. "The cat leads sort of a double life," Dr. Serpell asserted in a National Geographic story (*The Human-Cat Connection*, June 1997). "It likes to enjoy the fruits of domesticity. It likes to lead its own wild life too. It resists conforming to human standards."

### *What It Means to Be Owned by a Cat — An Owner's Perspective*

Cooly aloof, cats seem to have an almost calculating way of soliciting their owners' indulgence. Cat breeder Janet Wolf gave her personal account of the feline mystique that — in most households — renders the owner subservient to the cat.

"The question is not only who owns who," Ms. Wolf said, "but who's the boss." She remembers how one of her cats "taught" her father to give her treats by slinking past his legs. She related how her other cat taps her husband's arm each morning in order to procure her share of his donut.

Why all the fuss over a pet? Ms. Wolf answered this question with a flurry of revealing numbers. She said studies have shown that pet owners have significantly greater psychological health than people who do not own pets. In one study, cat owners over 60 years of age reported having greater life satisfaction and less loneliness, anxiety and depression one year after adopting a cat than did non-cat-owners.

"Cats buffer any sense of social isolation, provide companionship, can be icebreakers and social facilitators and can also be a source of social and tactile contact. They also offer stress reduction. Think of how relaxing it is to have a cat just purring on your lap."

All this coddling, she suggested, is the price one pays to win the affection of an animal that knows how to play "hard to get." Ms. Wolf, who has been breeding Birmans since 1987, introduced her cat family, members of whom each have their designated living quarters in her house. She said the accommodations she makes for them include buying their favorite foods, constructing cat "trees" to give her pets vertical space for climbing, hiring cat sitters when she goes away on vacation, even using only kitty-safe ornaments to decorate her Christmas tree.

"When we bought our first Birman, I don't think we ever envisioned becoming so involved with our cats. But after thinking this through," she conceded, "I am convinced without a doubt that I am owned by my cats."

### *Losing a Best Friend — Coping with the Death of a Cat*

Love is species-blind. In no way, perhaps, is this more apparent than in the manner in which a pet owner grieves the loss of a beloved animal. Mrs. Kathleen Dunn, M.S.W., social worker at VHUP, profiled the pet-owner relationship and explained the mourning process owners undergo when pets die.

Pets are humanized in modern American society, said Mrs. Dunn. Examples abound of owners who talk to and kiss their pets, even celebrate their pets' birthdays. "Through a process called 'attachment and bonding,' a very special relationship develops."

Among the accolades Mrs. Dunn has heard owners shower on their pets: "The fun the animal gives" and "No matter what happens at work, my cat is always there for me when I get home." "Unconditional love" is also a term that's used a lot," she added.

When she first joined the VHUP patient-care team, Mrs. Dunn figured she would be working mostly with the lonely elderly. To her surprise, she soon found that the people who needed

her services ran the age gamut.

She also learned that many of them — men and women alike — related to their pets as though the animals were their children. "Because this bond is so deep, the animal becomes a person to you, part of the family — sort of a perennial two-year-old. And if the relationship is threatened by death or illness, it's like a child dying. It doesn't matter that what died was 'only' an animal. A loss is a loss is a loss."

She recounted the case of an owner whose cat was stolen. Days later, the distraught woman was still dismantling the household in search of the missing cat. "She told me it felt as though she'd lost a child."

In her Pet Bereavement Support Group at VHUP, one of few such groups in the country, Mrs. Dunn sees many pet owners who are troubled in their mourning. It is not unusual for an owner to report seeing or hearing the deceased pet. Someone recently told her she thought she saw her dog — who died two years ago — walking down the street. She attributes this phenomenon to the fact that owners spend so much time caring for their pets that their presence becomes "ingrained" in their lives.

The grieving process for the deceased pet involves distinct stages of mourning, including guilt, which, she said, is the toughest to reconcile. Empathetic veterinarians can be particularly instrumental in helping owners deal with guilt, as this emotion is often linked to medical misperceptions, perhaps the notion that the animal died because the owner forgot to administer a pill, e.t.c. During this sorrowful time, owners may experience difficulty eating, sleeping and concentrating. The loss of their pet can even trigger the memory of a previous loss.

One of the most valuable coping strategies for dealing with pet loss is talking, particularly with someone who has also experienced the death of a pet and understands the emotional bond.

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said Mrs. Dunn, whose support group meets every other week. During the bereavement period, particularly the first two weeks following the pet's death — which are typically the most difficult to endure, it is important for one to resume one's schedule and get adequate exercise and nutrition. Other therapeutic options include reading about pet loss, writing about one's pet and joining a support group. Mrs. Dunn added that surviving animals, who also may be lamenting the loss of their buddy, should be comforted and given loving attention.



### **Feline Oral Health: Disease and Preventing It**

Cats are skilled hunters and, as such, supreme carnivores. Yet domestic felines lack true grit — dietetically speaking, because most commercial diets are deficient in the abrasive “toothbrushing action” of bones. Dr. William Rosenblad, resident in dental medicine at VHUP, discussed dental health in cats.

The importance of oral health in cats and dogs, said Dr. Rosenblad, cannot be overstated. “Because they use their mouths to eat, groom and communicate, their oral health has that much more importance.”

Two oral conditions to which cats are prone are resorptive lesions and ulcerative stomatitis. Both diseases begin with plaque, a gummy layer of bacteria and their by-products that coats the tooth, and subsequent periodontal disease. Within 24 hours of adherence to the enamel, plaque begins to mineralize into calculus, or tartar, which can be mechanically chipped away. The outer (buccal) surfaces of the upper teeth are predisposed to plaque formation because they lack both the abrasive, shearing forces that exist between the inside (lingual) surfaces of the upper teeth and the buccal surfaces of the lower teeth, as well as close contact with the tongue, which washes the lingual surfaces of the teeth with saliva.

Periodontal disease is probably the most prevalent health problem in cats and dogs. In fact, Dr. Rosenblad estimates, 75-90 percent of all adult cats have periodontal disease, and it is more prevalent in purebreds. Periodontal disease, which is manifest as either periodontitis or the more mild gingivitis, results when plaque and tartar build up under the gum line.

Gingivitis is a reversible condition apparent as a reddened, inflamed gum margin. Periodontitis is a comparatively more deep-seated infection affecting the structures (periodontal ligaments and bony tissue) that support the tooth within the alveolus, or tooth socket. The inciting bacteria, which travel inside the well-vascularized gingiva, can readily reach the bloodstream, leading to serious systemic ramifications. Furthermore, periodontitis, which in severe cases involves pus accumulation and oral tissue necrosis, can stress the immune system and additionally compromise cats suffering from concomitant systemic illnesses like renal and liver disease, and diabetes.

Periodontal disease is of greater consequence to cats than dogs because the former have a thinner, and therefore more vulnerable, band of gingiva attached to their enamel. Gingival recession leads to bone resorption or “cervical line (neck) lesions.”

“This is a progressive problem,” said Dr. Rosenblad. “This isn't important for only the affected tooth because this is basically an infection of the bone itself.”

Neck lesions, in which the tooth below the crown is eaten away, are the feline equivalents to cavities in people. These lesions are extremely painful due to both resorption into the innervated pulp canal and associated gingival inflammation.

The canine teeth are more likely than the molars or premolars to undergo root resorption. These cats may present with the affected canine tooth appearing longer than the contralateral normal tooth. The reason for this, explained Dr. Rosenblad, is that when the root re-

sorbs, the socket becomes inflamed and the crown is gradually extruded.

Neck lesions may be apparent by visual inspection of the oral cavity, but their presence can be confirmed radiographically. For cats showing clinical signs, such as refusal to eat, the affected teeth are typically extracted.

The second major feline oral disease, ulcerative stomatitis, involves generalized oral inflammation caused by an excessive immune response to plaque bacteria. Inflammation can be quite severe and culminate in tissue necrosis. Signs include drooling and anorexia. The acute stage of this illness is managed with antibiotics and antiinflammatory agents. Subsequent treatment may also include extractions, dental scaling and polishing, plaque retardants and antiviral agents. Ulcerative stomatitis must be differentiated from other causes of oral ulceration in cats, like kidney disease, oral eosinophilic granulomas and squamous cell carcinoma.

Dental prophylaxis is valuable both diagnostically and therapeutically. The extra-oral structures, including the head, eyes, ears, throat and lymph nodes, are typically examined. The intra-oral structures, such as the teeth, tongue and palate, are checked and a periodontal exam is performed under anesthesia. Each tooth is probed to detect crevices suggestive of neck lesions. Radiographs are made to locate resorptive lesions. Following any necessary tooth extractions, scaling and root cleaning are completed. Finally, the teeth are polished to smooth out any roughened surfaces to which bacteria can adhere. Prophylactic antibiotics are given to debilitated cats, such as those with heart or kidney disease, as well as those with severe oral disease.

When it comes to feline oral disease, prevention is an accessible goal. “This is one of the ways we can keep our cats happy,” said Dr. Rosenblad. He advises most owners to brush their cat's teeth at home (buccal surface of upper teeth using a brush with bristles) and to offer them abrasive food substances such as kibble (i.e. Hill's TD dental diet) and tartar-control chews.



## Feline Renal Transplantation

Kidney transplantation is a sophisticated procedure for changing the delicate blood "filter" that fails so many cats. Dr. Lillian R. Aronson, assistant professor of surgery at VHUP, described the transplantation technique, which is now available at VHUP, and reviewed patient selection criteria, post-operative care and prognosis for transplant patients.

Renal transplants in animals date back to the early 1900s. The first feline kidney transplant at a university hospital took place at the University of California, Davis in 1984. The patient, a Persian cat named Queenie, lived with normal kidney function for two years following surgery, eventually succumbing to heart failure.

One of the most important aspects of a successful renal transplant program, said Dr. Aronson, is careful patient selection. "Renal transplantation is an excellent treatment option for some cats, but it's not for every cat."

The ideal candidate is the cat in very early decompensated kidney failure. This status is gauged by body weight, which declines in debilitated renal failure patients. An acceptable candidate has up to a 10-20 percent weight loss. The recipient must also be free of other diseases, such as FeLV, FIV, heart disease, diabetes and a history of inflammatory bowel disease. Bloodwork and urine tests are performed on the potential recipient, as are EKG and chest/abdominal radiographs and ultrasound. If there is suspicion that a dormant medical condition like a urinary tract infection will be unmasked by the administration of the immunosuppressive drugs that maintain the cat following transplant, a two-week trial of these drugs is performed prior to surgery. Age is not a consideration for this surgery, said Dr. Aronson, whose transplant recipients have ranged in age from 2-16 years.

The kidney donor should be a healthy, young, FeLV/FIV-negative

adult cat, ideally the same size or slightly larger than the recipient. The cat should also be blood-crossmatch compatible with the recipient, as antigens present on red blood cells are also present on the endothelium of graft blood vessels. Blood and urine analyses are performed, as is excretory urography to assure that the donor has two normal-shaped, well-vascularized kidneys. The other major condition is that the donor cat, which comes from the Pennsylvania S.P.C.A., must be adopted by the owner of the recipient cat.

"This has been a very positive part of the program," said Dr. Aronson. "Owners love it. They feel they are saving the life of the cat that saved their cat's life."

Unilateral kidney removal does not clinically compromise the donor, she added. In a recent study, about 20 donor cats were followed post-surgery. Only two of these cats showed mild changes in urine-concentrating ability and minor increases in serum creatinine; they remained clinically normal.

Presurgical preparation is crucial to the success of renal transplantation. The recipient is diuresed with a balanced electrolyte solution and fed a protein-restricted diet. Anemia, a serious byproduct of renal failure, is corrected with either whole-blood transfusion or erythropoietin administration. Beta-blockers are given if blood pressure is dangerously elevated, and a glycerin suppository is administered to both the donor and recipient the night before surgery to empty their colons.

To decrease the likelihood of organ rejection, immunosuppressive drugs are started. The recipient is given cyclosporine orally 1-2 days before surgery. Prednisone is administered orally starting the day of the procedure.

The transplant procedure involves two surgical teams working on both cats simultaneously. The donor cat is brought to surgery first and opened along the ventral midline. Using loupes that provide magnification for vascular dissection, the left and right kidneys are examined for vascular pedicles consisting of suitable vessels. The left kidney is preferred because of its slightly

longer vein. The vessels and ureter are carefully dissected out and cleaned.

Once the recipient is opened and prepared to receive the kidney, donor nephrectomy is performed and the renal vessels of the transplanted kidney are anastomosed to the recipient's aorta and caudal vena cava. The ureter is sutured into the bladder and, to prevent torsion of the vascular pedicle, the transplanted kidney is sutured to the adjacent abdominal wall.

The native kidneys are biopsied but usually left *in situ* as a reserve should the donor kidney fail. Most transplanted kidneys are functioning well by 72 hours after surgery, at which time dramatic clinical improvement is generally evident; if the transplanted kidney fails to function normally, re-transplantation is an option for most patients.

Post-operative handling and stress should be minimized. IV fluids, gastrostomy tube feedings, antibiotics and cyclosporine are administered. Cyclosporine levels are checked regularly. The cat is discharged once graft function is determined to be stable. Intravenous cyclosporine is sent to the referring veterinarian's hospital for use in an emergency rejection episode. Bloodwork at the referring hospital to monitor cyclosporine levels and creatinine must be performed weekly until drug levels are stable, and then every 2-3 months thereafter.

Renal transplant surgery mandates extensive owner commitment and expense. The procedure costs \$4-5,000 if no complications develop. For the average-sized cat, the cost of cyclosporine, which must be given for the remainder of the recipient's life, runs \$.30-2.40 per day. And there are no guarantees: 70 percent of patients survive the surgery and are home for at least one year with normal kidney function; the mean post-operative survival time is 26 months.

"Owners really need to understand the risks," cautioned Dr. Aronson. "You're taking a cat with an underlying fatal disease and putting him through a big procedure he may not survive."

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### *Caring for the Critically-Ill Cat*

Contrary to popular folklore, cats do not have nine lives. Fortunately, sophisticated emergency and intensive care measures are available to save critically decompensated cats. Dr. Deborah C. Mandell, lecturer in emergency medicine at VHUP, provided an overview of the four major body systems and discussed critical care management procedures for insults to those systems in cats.

Feline critical care is problematic for several reasons. First of all, Dr. Mandell said "Cats are notorious for compensating very well in response to certain diseases. So by the time they're showing signs, they're already in a very advanced state of disease."

To worsen matters, critically-ill cats can become easily stressed and tolerate little manipulation, rendering medical workup and treatment somewhat precarious. The four critical organ systems, which must be rapidly assessed in cats presenting for emergency care, are the respiratory, cardiovascular, renal and neurologic systems.

The most common causes of respiratory distress in cats are asthma, heart disease and pleural space disease. A thorough physical exam and radiographs are essential in distinguishing between these.

On physical exam, respiratory competency is evaluated by checking mucous membrane color, which should be pink, and respiratory rate (normal feline respiratory rate is 15-36 breaths per minute) and effort. For a cat in severe respiratory distress, which can be manifest by and/or nostril flaring open-mouth breathing, the exam is temporarily suspended. Oxygen is administered through either a flow-by tube held near the nostrils; an oxygen mask if the cat is placid and/or comatose; or placement in an oxygen cage, which supplies air comprised of as much as 60 percent oxygen.

The next stop on the physiologic route is the cardiovascular system,

which distributes inspired oxygen throughout the body. Cardiovascular health is reflected in mucous membrane color and capillary refill, time pulse rate (normal feline pulse rate is 160-220 beats per minute) and quality, and heart beat-peripheral pulse synchrony. A common feline problem that can lead to cardiovascular disease is chronic renal failure. Cats do not show signs of renal failure until 75-80 percent of kidney function is lost. At this point, toxins accumulate in the blood and serum creatinine and blood urea nitrogen (BUN) rise, leading to anorexia, nausea and vomiting. Sequelae of this vicious process include hypovolemia and anemia, both of which compromise cardiovascular status.

These patients are infused with intravenous fluids at high rates, and often prescribed regular subcutaneous fluids to be administered at home for the remainder of life. H-2 blockers are administered to prevent stomach ulcers. Phosphate binders are given to reduce serum phosphorus, which becomes elevated in animals with renal failure and leads to nausea and anorexia. Chronic renal failure is progressive and ultimately incompatible with life.

The renal system can be impacted by problems other than primary kidney dysfunction. "It's not just whether a cat is able to produce urine, but also whether the cat is able to excrete urine," Dr. Mandell explained.

Feline urethral obstruction is a life-threatening emergency caused by mineral crystals or mucus plugs that clog the distal urethra and block urine flow and potassium excretion. Rising serum potassium levels can slow or stop the heart. Signs of feline urethral obstruction, to which male cats are predisposed, include straining to urinate, frequent trips to the litterbox, vocalizing and vomiting. Treatment involves sedating the cat and mechanically dislodging the obstruction. Intravenous fluids are also administered at high rates, as is medication to decrease potassium, and transfusion in the infrequent cases involving substantial blood loss.

The fourth emergency system, the

neurologic system, is assessed by surveying mentation and gait. Impaired mentation may be manifest by decreased responsiveness, depression or stupor. The most common feline neurologic gait abnormality is hindlimb paralysis. This is typically caused by emboli that lodge in the distal aorta, severing blood flow to the hind legs. A cat that presents with this painful condition, which usually occurs secondarily to myocardial disease, usually has cold paralyzed hindlimbs with absent pulses. The prognosis for this disease is poor.

Other critical conditions peculiar to cats arise from idiosyncracies of feline metabolism. Obesity in cats is a risk factor for diabetes and hepatic lipidosis. Hepatic lipidosis, which is life-threatening, can develop in cats when they refrain from eating for days to weeks. Fat infiltrates and enlarges the liver, and the animal becomes icteric. The intensive therapy these patients require includes intravenous fluids, nutrition and treatment of the underlying cause of anorexia.

Alternate feeding mechanisms for anorectic cats include nasogastric tubes; PEG (percutaneous and endoscopically-placed gastrotomy) tubes, which is implanted through the body wall into the stomach; jejunostomy tubes, which is inserted through the body wall into the jejunum, thereby bypassing the stomach (used in vomiting cats); and total parenteral nutrition (TPN), which is given intravenously to cats that cannot tolerate food. Force feeding is another option, but is not recommended in cats because it can result in aspiration or development of food aversion.

Cats have few options for pain relief due to their inability to process certain substances. Because they cannot metabolize acetaminophen, Tylenol is lethal to cats. Other non-steroidal antiinflammatory drugs (NSAIDs) like ibuprofen, can cause acute renal failure and gastric ulcers in cats. Gastric lavage is usually effective in patients that are presented for emergency treatment within four hours following such toxin ingestion. J.C.