During the first half of the 20th century, cats were virtually ignored by the veterinary community and were treated similarly to dogs. With the introduction of commercial clay litter in 1947, many cats moved indoors and became cherished members of the family. Caring owners began seeking veterinary care for cats, and the veterinary community responded. Many factors have driven the interest in feline medicine. Many veterinarians simply prefer working with felines and realize how difficult it is to stay current on veterinary advances in multiple species. Extrapolating treatment of canine diseases to cats is usually unsuccessful, verifying the accuracy of the adage, "cats are not small dogs." Species specialization allows veterinarians to refine their skills, focus their knowledge, and better meet increasing client demands for high quality care and complex treatments. Financial incentive has also driven the increased interest in feline medicine. Cats now outnumber dogs as companion animals in both the United States (U.S.) and the United Kingdom (U.K.). Veterinarians have recognized feline medicine as a growing niche, one in which they can financially and professionally excel.

The Beginnings

The First Feline-Only Veterinarian

Louis J. Camuti immigrated to the U.S. as a young boy in 1902. After graduating from veterinary school, Camuti treated both dogs and cats in New York City. He soon recognized that cats were neglected in the world of veterinary medicine, and also noticed how cats loathe traveling. These observations led the pioneering doctor to launch the first feline-only house call service in 1932. Over the next 50 years, Camuti's colorful personality and inexhaustible energy earned him many devoted clients.
The First Feline-Only Clinic
The first feline-only brick-and-mortar clinic, "The Cat Clinic", was established in 1955 by Dr. Robert L. Stansbury in Pasadena, California. Prior to that time, Stansbury treated both dogs and cats before he decided to devote his career to cats, a move far ahead of its time. Today, there are over 200 feline-only clinics in the U.S., and 488 feline-exclusive veterinarians listed in the American Veterinary Medical Association's (AVMA) membership database.

Early Feline Medicine Texts
One of the earliest books discussing the diseases of cats was published in 1887 by Rule. Other authors of feline medicine texts published around the turn of the 20th century included Huidekoper, Hill, and Barton. Although diagnosis and treatments at the time were crude compared to today's standard, the early authors recognized the dearth of feline medical literature and attempted to improve the welfare of felines by disseminating written information to veterinary professionals. Writings on feline medicine remained sparse until the last half of the 20th century. Today, feline-specific information is included in all major companion animal veterinary texts, and there are numerous texts solely dedicated to feline medicine.

History of Select Feline Diseases: Infectious
Panleukopenia
Feline panleukopenia (FP) is arguably the most important disease in the history of the cat. Clinical signs were recognized prior to the twentieth century and thought to be caused by a bacterium, but the viral nature of the disease was identified by Verge and Cristofoleti in France in 1928. Although the disease was initially referred to by several names, including "infectious viral enteritis" and most notoriously "feline distemper," Hammon and Enders named it "panleukopenia" in 1939 when they observed the comprehensive leukopenia the disease caused. The name FP was officially adopted in 1971 by the AVMA's Committee on Nomenclature. Originally the FP virus (FPV) was part of a group of viruses called picornaviruses, later renamed parvoviruses.

Panleukopenia killed many cats, with infection and clinical disease approaching 100 percent in susceptible populations, and mortality ranging from 30 percent to 90 percent. The disease mostly affected young kittens, but adults sometimes succumbed. As child growing up on a farm in the 1940's, Dr. Fred Scott, the first director of the Cornell Feline Health Center, recalls a year when all but one of the many barn cats on his family farm died of panleukopenia. Scott's surviving cat, appropriately named "Lucky Cat" by the young boy, went on to instill a deep admiration for felines, and prompted Scott to pursue a veterinary career during which he studied many feline infectious diseases, including FP.

Crude tissue vaccines produced by filtration of viruses from infected tissues were shown to protect cats from FP as early as 1934. A commercial tissue vaccine was introduced in 1940 and proved to be clinically effective. Feline panleukopenia virus was isolated in cell culture by Slater during 1962-63 at Philips Roxane, Inc., making possible the creation of tissue-culture vaccines, with the "PR" strain still being used today.

Several developments in the mid-1960's, including isolation and propagation of the virus in cell culture and the development of a serum-neutralization and immunofluorescence test, enabled the study of the virus in vitro and the determination of serum antibody titers. The classic cerebellar neurological signs seen in kittens upon ambulation were not associated with the virus until 1967 when Johnson and others confirmed that the previously identified feline ataxia virus was actually the FP virus. Although FP is not commonly encountered in general practice today due to adherence to recommended vaccination protocols, devastating outbreaks in shelters still occur, sometimes leading to euthanasia of all exposed cats and kittens.

Respiratory Pathogens
In 1942, James A. Baker at Cornell University isolated a psittacoid organism that formed intracytoplasmic elementary bodies. Disease caused by the organism was called pneumonia.
because of the lung consolidation produced in infected animals. Unfortunately, the term pneumonitis was used to refer to a complex of upper respiratory infections of cats, regardless of whether a specific agent had been identified. Once other respiratory pathogens were identified in the late 1950's, the importance of the pneumonitis pathogen as a major cause of respiratory infection was questioned. The pathogen identified by Baker was originally called *Miyagawanela felis*, and later named *Chlamydia psittaci*, now referred to as *Chlamydophila felis* and thought to be predominantly a conjunctival pathogen.

The first member of the feline calicivirus (FCV) family was isolated in 1957 by Fastier. FCV was implicated as a cause of upper respiratory illness in cats, although in severe cases the pathogen could cause pneumonia and death. FCV was considered a picornavirus until 1971 when the genera calicivirus was designated.

In 1957, Crandell and Maurer isolated a pathogen from feline respiratory epithelium that formed intranuclear inclusion bodies. The agent was identified as a herpesvirus and was thought to be a major contributor to respiratory illness. In 1959, Crandell and Despeaux proposed that the name, "feline viral rhinotracheitis" (FVR) be used for the clinical signs caused by feline herpesvirus (FHV). Like FCV, FHV usually involved only the upper respiratory tract, although involvement of other organs was occasionally seen.

No vaccine for FVR or FCV was available until the mid 1970's, so control measures were the first line of defense used to prevent spread of the infection. Because cats could be non-clinical shedders of virus, prevention of disease dissemination was difficult. The vaccinations available today do not prevent disease or the carrier state, but do ameliorate clinical signs. Upper respiratory infections are still endemic in multiple cat environments, such as shelters and catteries, despite strict adherence to vaccination, cleaning, and management protocols.

Since 1998 there have been 6 reported outbreaks in the U.S. of a virulent strain of calicivirus causing a highly contagious febrile hemorrhagic syndrome, with mortality rates as high as 50 percent. Fortunately, the outbreaks have been self-limiting, but the extent of future occurrences is unknown.

**Feline Infectious Peritonitis**

A febrile disease causing ascites and fibrin deposition on abdominal organs was first described in 1963 by Dr. Jean Holzworth, a graduate of
Feline Immunodeficiency Virus

Another retrovirus was isolated in 1987 by Pedersen and coworkers. The virus was identified as a lentivirus and tentatively named feline T-lymphotropic lentivirus (FTLV), but later changed to feline immunodeficiency virus (FIV). The virus is antigenically distinct from the human AIDS virus, although the two viruses share some morphologic and biochemical similarities. Immunosorbent and Western blotting techniques were employed to detect circulating antibodies to FIV, and by 1990, a commercial ELISA became available, permitting swift detection of infected cats in the field. The belief that FIV has existed in cats for some time has been supported by a retrospective study done in the U.K. that found antibodies to FIV in frozen cat serum dating from 1975-76. Transmission primarily occurs via saliva through bite wounds, although a 2000 study found that FIV was transmitted in a closed household of amicable cats.

A whole-virus vaccine for FIV was introduced in 2002, but its use remains controversial primarily because antibodies raised in response to vaccination are indistinguishable from those due to natural infection, preventing the accurate diagnosis of the disease by all currently available testing methods that depend on antibody detection. Even available polymerase chain reaction (PCR) assays, which detect proviral DNA, have been unable to differentiate between naturally infected and vaccinated cats, and have not solved the diagnostic problem.

With the discovery of feline retroviruses such as FeLV and FIV, the cat became the center of much attention and the recipient of research funding from the medical field due to the use of the cat as an animal model for human disease.

History of Select Feline Diseases: Non-infectious

In her 1963 article "Some Important Disorders of Cats," Dr. Jean Holzworth, a highly regarded feline advocate and practitioner who spent most of her career tending to cats at Angell Memorial Animal Hospital in Boston, Massachusetts, discussed what she called feline "specialties." Some of the feline ailments discussed by Holzworth, such as urinary "sand" and chronic kidney disease, are still important feline

The prevalence of FeLV has been decreasing internationally since the mid 1980's with infection rates ranging between 1 percent and 8 percent today.

The prevalence of FeLV has been decreasing internationally since the mid 1980's with infection rates ranging between 1 percent and 8 percent today. This decrease in prevalence is thought to be due to improved detection and prevention strategies. Interestingly, FeLV-associated lymphoma cases dropped from about 70 percent of lymphoma cases before 1983 to 14.5 percent during the period between 1983 to 2003—this despite a dramatic increase in the total number of lymphoma cases.
diseases today. In addition, other diseases afflicting cats have emerged over the past 40 years. The following section will explore some of the cat "specialties" described by Holzworth, as well as more recent disease entities.

**Feline Lower Urinary Tract Disease**

Feline lower urinary tract disease (FLUTD) encompasses several disorders of varying causes producing similar clinical signs. Cystitis and hematuria were reported as being common in the cat as early as 1925. The collection of urinary tract disorders was originally referred to as feline urologic syndrome (FUS), but in the mid 1980's it was recommended that the individual disorders be more precisely defined to prevent confusion. The "syndrome" of diseases is now commonly called FLUTD. By far, the most frequent disorder is feline interstitial or idiopathic cystitis (FIC), a diagnosis made by ruling out other urinary tract diseases. FIC is believed to result from neurogenic inflammation of the bladder, and it usually resolves within a week regardless of treatment. Recent work has focused on the role that environmental stress and internal predisposition play in the development of FIC, and how modification of an affected cat's environment can help alleviate clinical signs. It is hypothesized that numerous complex abnormalities of the neuroendocrine system interact, resulting in morbidity of the bladder as well as other organs.

Urolithiasis is the second most common disease recognized in the FLUTD complex. The composition of feline uroliths has changed significantly over the past 20 years. In 1981, 78 percent of uroliths were composed of magnesium ammonium phosphate (MAP), or struvite, with only 1 percent composed of calcium oxalate (CaOx). In the mid 1980's, it was shown that MAP uroliths could be dissolved by feeding magnesium-reduced acidifying diets, and cat food manufacturers responded by changing their formulations. The strategy worked, and by 1999, the incidence of MAP uroliths had dropped to 32 percent. Interestingly, the number of CaOx uroliths increased to 55 percent during the same period. Whether consumption of magnesium-reduced acidifying diets predisposed cats to formation of CaOx or whether other factors were involved is not understood. Today, veterinary diets are formulated for specific types of stones, and new diets have been recently introduced that claim to reduce risk of both MAP and CaOx uroliths.

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**History of Feline Medicine Timeline 1964-1981**

1964 Jarrett et al identified feline leukemia virus as cause of feline lymphosarcoma.

1967 Johnson et al confirmed feline ataxia virus causing cerebellar hypoplasia in young kittens was actually the FP virus.

1970 The American Association of Feline Practitioners (AAFP) was founded by early leaders Barbara Stein, Fred Scott, and William Hardy, Jr.

1971 *Feline Practice*, a bimonthly feline-only journal for veterinarians, began publication.

1973 FeLV's contagious nature reported by Hardy et al.

FeLV immunofluorescence assay was introduced, enabling testing of cats in the field and significantly reducing spread of the disease.

1974 The Cornell Feline Research Laboratory was founded under the directorship of Fred Scott; the name was changed in 1978 to the Cornell Feline Health Center.

1975 Hayes et al experimentally created retinal degeneration in cats by feeding a taurine-deficient diet.

1976 Schneck and Osborn showed that lesions on cat teeth, now referred to as "feline odontoclastic resorptive lesions" (FORL), are caused by resorption and are not caries, confirming Hopewell-Smith's findings in the 1920's.

1978 A viral agent was found to be the agent in "fibrinous peritonitis." The agent was identified as feline coronavirus (FCoV) in 1979.

1979 Feline hyperthyroidism was first reported, and is now considered the most common endocrinopathy in cats today.

1981 Composition of feline uroliths: 78 percent magnesium ammonium phosphate (MAP), 1 percent calcium oxalate (CaOx). In the mid 1980's it was shown that MAP uroliths could be dissolved by feeding magnesium-reduced acidifying diets, and cat food manufacturers responded by changing their formulations.
Another major urinary tract disorder seen in cats is urethral obstruction, most commonly seen in neutered male cats. Urethral plugs, composed of large amounts of mucoproteinaceous matrix material sometimes mixed with smaller amounts of minerals, block the penile urethra, resulting in a life-threatening condition. Advancements in treatment and prevention, and increasing owner awareness of this deadly disease are paramount to reducing its incidence.

**Taurine Deficiency**
Several disorders in the cat are related to taurine deficiency, the two most significant being retinal degeneration and dilated cardiomyopathy (DCM). Taurine is a sulfur-containing amino acid and is the major free amino acid in mammalian tissue. It is highly concentrated in the retina and myocardium. Two reasons account for the cat's absolute requirement for dietary taurine: cats are incapable of synthesizing sufficient taurine from other sulfur-containing amino acids, and cats exclusively use taurine in bile acid conjugation. This contrasts with other species that can substitute glycine when taurine levels are low. Although taurine is abundant in animal tissue and seafood, cats eating commercial diets available at the time became deficient in the nutrient. This was due to the high level of carbohydrate used in commercial dry food, coupled with the low bioavailability of taurine in processed foods, even if those foods had been supplemented. The cause of the poor bioavailability of taurine is not understood.

Experimentally created retinal degeneration in cats being fed a taurine-deficient diet was reported in 1975. The bilateral symmetrical lesions had a characteristic appearance on fundic examination. If caught early and the cat received taurine supplementation, vision could be maintained, although the retinal damage was irreversible. If the taurine deficiency was not corrected, the photoreceptor cells atrophied and disappeared, resulting in total and irreversible blindness.

The development of DCM in cats being fed a taurine-deficient diet was first reported in 1987. Upon taurine supplementation, the cardiac abnormalities in all of the cats in the study resolved. Cat food manufacturers responded to this finding by reformulating their feline diets to supply adequate levels of this important nutrient. Subsequent studies have revealed that not all cats develop DCM on taurine-deficient diets, suggesting that other factors may be involved. Because DCM due to taurine deficiency has virtually disappeared since additional taurine supplementation of commercial diets began in 1987, other potential factors that may contribute to the development of DCM have not been explored.

**Feline Odontoclastic Resorptive Lesions**
There was debate over the existence of feline dental caries until 1976, when Schneck and Osborn determined that the lesions found in cat teeth are not characteristic of human dental caries but are caused by resorption. Although Hopewell-Smith had described lesions in the teeth of cats caused by a resorptive process in the 1920's, authors continued to call these lesions caries until 1976. The feline disease is similar to the human disease. In 2005, a single base pair change in the feline MYBPC3 gene was identified and found to be responsible for the sarcomeric abnormality. It is hoped that the naturally occurring model of familial HCM will enable study of pathophysiological processes in the development of HCM and aid in developing effective treatment.
stomatitis is not associated with the increased incidence, and eating dry food does not appear to protect against development of the lesions.

Cats with FORL have recently been found to have increased levels of urine 25-hydroxyvitamin D and lower urine specific gravities than cats without lesions, but parathyroid hormone levels in affected cats was within reference range. Thirty one percent of commercial cat foods studied had excess vitamin D3. In experimental animals, it was shown that consumption of excess vitamin D or vitamin D metabolites caused soft tissue mineralization, varying degrees of renal disease, and changes to dental tissue that resembled FORL. The authors recommended that further studies be undertaken to verify relations between FORL, vitamin D, and renal insufficiency.

Recently, scientists have cultured feline osteoclasts, the cells responsible for bone resorption, and have tested the efficacy of several resorption inhibitors, including bisphosphonates, the drugs used to treat humans with osteoporosis and other bone diseases. Ultimately, pharmaceutical treatment of FORL may offer relief for the large number of cats affected with the disorder.

Vaccine-Associated Sarcomas
The first report of a fibrosarcoma forming at a vaccine injection site was in 1991, following a period of increased frequency of vaccination of cats for rabies and FeLV with adjuvanted vaccines. Subsequent retrospective and prospective studies confirmed the association between vaccination and sarcoma formation, and estimated the incidence to be low (2/10,000 cats). The cause of the formation of the sarcoma is still not completely understood, although exaggerated inflammatory or immunologic reactions, or both, are suspected to play a role. In 1996, the Vaccine-Associated Feline Sarcoma Task Force (VAFSTF) was formed by bringing together experts to analyze the issue, educate veterinarians, initiate research, make recommendations, and act as a liaison to the public. The American Association of Feline Practitioners (AAFP) published vaccination guidelines which significantly changed the frequency and number of vaccines administered to individual cats. The guidelines were first published in 1998 and updated in 2000. The 2006 AAFP “Feline Vaccine Advisory Panel Report,” the most recent update, was published in the November 1, 2006, issue of the Journal of the American Veterinary Medical Association.

The occurrence of vaccine-associated sarcomas in cats influenced can-
Necrotizing fasciitis occurs in general because it demonstrated the need for aggressive and early treatment, and highlighted the grave consequences of inappropriate and partial treatment. The VAFSTF was initially designed to function for 3 years, however, the need for the group continued. The VAFSTF officially concluded its work in late 2004 by holding a roundtable discussion, although there is still an active VAFSTF spokesperson. Unfortunately, the problem of VAFS has not been resolved, but the importance of the issue is clear and research continues. Vaccine manufacturers have responded over the past decade with new vaccine formulations and delivery systems. Whether these new products, coupled with the change in vaccination guidelines, will lower the incidence of VAFS is not yet known.

**Diseases of Older Cats**

Four diseases that play an important role in the well-being of older cats include chronic renal disease, hyperthyroidism, diabetes mellitus, and osteoarthritis. While these diseases can affect cats of any age, the highest prevalence is in aging cats. Since cats are living longer lives, these diseases will become increasingly important to veterinary medicine.

**Renal Disease**

The number of cats diagnosed with chronic renal disease (CRD) increased 9-fold between 1980 and 2000. Currently an estimated 2 million felines are afflicted. Age is a risk factor, with 49 percent of cats over the age of 15 suffering from the disease. Whether the increased recognition is due to heightened awareness on the part of owners and veterinarians, or to a true increase in incidence is not known. Although there are some familial causes of feline CRD such as amyloidosis in Abyssinians and polycystic kidney disease (PKD) in Persians and Exotics, the cause of CRD in most cats is unknown. Advances in early diagnosis, nutritional therapy, and at-home care, combined with other medical therapies, can allow cats with CRD to live a quality life for extended periods after being diagnosed with CRD.

New treatments and preventative protocols for CRD and its secondary effects have been established. The first kidney transplant in a cat was performed in 1987, and the surgery is performed at several institutions today. Although complications associated with immunosuppression and allograft rejection occur, improvements in surgical technique and perioperative management have improved 3-year survival rates to 42 percent. Other advances in treatment of CRD include the development of a recombinant feline-specific erythropoietin (rFEPo) to treat CRD-associated anemia. Unfortunately, the rFEPo is unable to eliminate the red cell aplasia sometimes seen when human rEPO is administered to cats. Another promising technology being studied for the treatment of CRD-associated anemia is the use of a recombinant virus vector containing the rEPO gene. Finally, in an effort to eradicate PKD, a genetic test has been developed and a registry is being maintained by the Feline Advisory Bureau in the U.K.

One possible cause of CRD has been explored by Lappin and coworkers who demonstrated that cats inoculated with parenteral FVRCP vaccines develop antibodies to feline kidney cells. This is due to the presence of feline kidney cell proteins in the vaccine, the substrate on which the viruses are propagated. No cats in the study showed histological evidence of kidney disease during the 56-week study, but longer-term effects are still unknown.

**Hyperthyroidism**

Another prominent disease diagnosed most commonly in older cats is feline hyperthyroidism (FH). The mean age affected is 13 years, but FH has been reported in cats ranging in age from four to 22 years. The disease was rarely recognized prior to 1979, but since that time has become the most common feline endocrinopathy diagnosed today. Benign functional adenomatous hyperplasia of the thyroid gland is the most frequent diagnosis (98 percent) and is often (70-80 percent) bilateral. The typical histopathological findings are comparable to the second most common thyroid disorder in people, toxic nodular goiter or Plummer's Disease. Toxic nodular goiter most commonly affects older women and its cause has not completely been elucidated. Similarly, in cats, older animals are most commonly affected but a gender predilection has not been recognized. The pathogenesis of FH remains unclear despite numerous epidemiological and molecular studies. Whether the emergence of FH in 1979 indicates a new disease, an epidemic of a rare disease, or can be attributed to the aging of the feline population is not understood.

Whether the emergence of feline hyperthyroidism in 1979 indicates a new disease, an epidemic of a rare disease, or can be attributed to the aging of the feline population is not understood.
Environmental, genetic, and nutritional risk factors for FH have been identified, but none has proven to be both necessary and sufficient to cause the disease; the cause is most likely multifactorial. Fortunately, there are very effective treatment options available.

**Diabetes Mellitus**

Diabetes mellitus (DM) is another disease for which the risk increases with age. Similar to the situation in humans, its incidence is on the rise in felines and is most likely due to increased obesity; obese cats have impaired glucose tolerance and abnormal insulin response to a glucose load. Until recently, feline DM was treated similarly to canine DM, but important differences between the two species must be considered when treating diabetic cats. For instance, cats often oscillate between an insulin-dependent and non-insulin-dependent state, and about 20 percent of diabetic cats experience a transient state of diabetes that resolves upon treatment and allows cessation of insulin therapy. Another clinical presentation sometimes seen in diabetic cats is a plantigrade stance and weakness in the hind limbs due to a neuropathy, which usually resolves upon successful treatment.

New techniques for owner monitoring of diabetic cats at home have been developed. These include a continuous glucose monitoring system that utilizes a sensor placed in the subcutaneous tissue, and a lancing device used to draw a drop of blood from a vessel in the pinna that is subsequently analyzed in a portable blood glucose meter. If successful, monitoring of blood glucose levels at home should provide a more accurate assessment of the cat’s response to therapy since, theoretically, there is less stress in the home environment.

Traditionally, a high fiber, restricted fat diet, similar to that recommended for human diabetic patients, was rec-

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### History of Feline Medicine Timeline 1996-2000

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<tr>
<th>Year</th>
<th>Event</th>
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<td>The Vaccine-Associated Feline Sarcoma Task Force (VAFSTF) was formed to analyze vaccine-associated fibrosarcomas, educate veterinarians, initiate research, make recommendations, and act as a liaison to the public. FAB created the European Society for Feline Medicine (ESFM) to provide veterinary surgeons across Europe with information and continuing education on feline medicine.</td>
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<td>1998</td>
<td>The first feline vaccination guidelines were published by the AAFP and the AFM, in conjunction with the VAFSTF. First of 6 U.S. outbreaks of a virulent strain of calicivirus causing a highly contagious febrile hemorrhagic syndrome.</td>
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<td>1999</td>
<td>Composition of feline uroliths: 32 percent MAP, 55 percent CaOx. Whether consumption of magnesium-reduced acidifying diets introduced in the 1980’s predisposed cats to formation of CaOx or whether other factors were involved has not been elucidated. Prahl and others reported that diabetes mellitus was on the rise in felines and most likely due to increased obesity. Kittleson et al reported the establishment of a colony of Maine Coon cats with naturally occurring hypertrophic cardiomyopathy (HCM) that could be used as an animal model for HCM in people. The European Society of Feline Medicine (ESFM) began publishing the <em>Journal of Feline Medicine and Surgery</em> featuring original research and case reports. In 2002, the AAFP joined the ESFM in the journal’s publication.</td>
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<td>2000</td>
<td>The number of cats suffering from chronic renal disease (CRD) increased 9-fold between 1980 and 2000, and now afflicts over 2 million, with 49 percent of cats over the age of 15 suffering from the disease. An updated version of feline vaccination guidelines is published by the AAFP and AFM.</td>
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ommended for diabetic cats. Because cats are obligate carnivores whose metabolism of nutrients is unique among mammals, this recommendation has been reassessed. Recently, the feeding of a high protein low carbohydrate diet for diabetic cats has been explored and has produced improvement in glycemic control in many cats with DM.

**Osteoarthritis**

Several recent reports suggest that feline osteoarthritis (OA) is much more prevalent than previously believed. One retrospective study found that 90 percent of geriatric cats over 12 years old had radiographic evidence of OA; however, joint disease was only noted on the records of 4 of these cats. It is becoming clear that feline OA is significantly underdiagnosed, perhaps partly due to the lack of clinical signs demonstrated by affected cats, or to failure on the part of owners and veterinarians to recognize them.

Because of the cat's stoic nature, it can be challenging to recognize signs of OA, but with more cats living longer lives, it is imperative that the disease be diagnosed so that palliative treatment can be offered. Management of OA in cats presents a challenge, and differs significantly from treating canine OA. Environmental modification plays a major role in improving the quality of life in cats suffering from OA. Medical management is especially difficult, since there are no drugs licensed for treatment of chronic pain in the cat. Some clinicians are employing off-label use of certain medications, but extreme caution must be exercised. Although there are some chondroprotectants licensed for use in cats, the efficacy of these has been inadequately explored by controlled studies.

**Controversial Feline Issues**

Several issues involving felines polarize veterinarian professionals as well as cat fanciers and animal welfare workers. Controversial issues include the plight of homeless and feral cats, declawing, and cloning of cats.

**Feral Cats**

It is estimated that there are between 25 and 60 million free-roaming cats in the U.S. Some of these free-roaming cats were previously owned cats who were lost or abandoned, while some were born in the wild and have had no human contact. This large population of cats raises welfare, environmental, and human health issues, and has been the topic of debate among various groups for over 50 years. One approach to effectively manage these cats is trap-neuter-return (TNR) whereby cats are humanely trapped and surgically neutered. Cats that are able to positively interact with people are adopted into homes, while true ferals are returned to their original environment where they are cared for and monitored by dedicated colony caretakers. Advocates of TNR claim that it is the only effective and humane way to deal with feral cat populations and will eventually lead to declining numbers of homeless cats.

Advocates of trap-neuter-return claim that it is the only effective and humane way to deal with feral cat populations and will eventually lead to declining numbers of homeless cats.
Onychectomy

Onychectomy, or declawing, is not performed, and indeed is illegal, in many parts of the world. It is estimated that at least 25 percent of the owned American cat population is declawed. Opponents of declawing state that scratching, and the emotional and physical needs that it fulfills, is an innate part of the cat's being, and it is inhumane to deprive cats of their natural behavior. Indeed, with owner participation, cats can be trained to scratch appropriate objects. Opponents also claim that long-term risks of onychectomy have not been clearly defined, and that the complications do occur. They also believe that taking unnecessary surgical risk for an elective procedure is inappropriate.

Proponents of declawing state that behavioral problems are the major reason for euthanasia, relinquishment, or abandonment of pet cats, and that by removing claws of cats who scratch will help to keep those "destructive" felines in their homes. Proponents cite studies that have shown that with proper surgical technique and perioperative pain management, most cats recover comfortably and without complications.

The AVMA, AAFP, and Canadian Veterinary Medical Association take similar positions regarding declawing. Although the organizations discourage routine declawing and encourage informing owners about natural feline behavior and ways to train cats to scratch appropriate substrates, each condones declawing when there is potential human risk involved (e.g., when cats reside with immunosuppressed individuals) and when inappropriate scratching threatens the stability of the owner-cat bond and might lead to euthanasia.

In April 2003, the city of West Hollywood, California passed a law prohibiting declawing in that city. The law was praised by many, and condemned by others, most notably the California Veterinary Medical Association (CVMA). The CVMA stated that the law breached veterinarian's rights to practice within the boundaries of their licenses. In late 2005, after a long debate between the city and the CVMA, a state court in California struck down the West Hollywood ordinance banning declawing, once again making the procedure legal in that jurisdiction.

Cloning

In 2001, the first kitten cloned via nuclear transplantation was delivered via cesarean section to her surrogate mother at Texas A&M University.

2001 "CC", the first kitten cloned via nuclear transplantation, was delivered via cesarean section to her surrogate mother at Texas A&M University.

2002 A commercial FIV vaccine was introduced. A retrospective study found that 90 percent of geriatric cats >12 years old had radiographic evidence of osteoarthritis (OA), a disease not well studied in felines.

2003 The city of West Hollywood, California, passed a law prohibiting onychectomy.

2004 CSC delivered the first cloned cat for a paying client using chromatin transfer, a more efficient technique than the nuclear transplantation technique used to create "CC".

2005 Meurs et al identified a single base pair change in the feline MYBPC3 gene as the cause of the sarcomeric abnormality causing HCM in a colony of Maine Coon cats with naturally occurring disease.

Lappin et al demonstrated that cats inoculated with parenteral FVRCP vaccines develop antibodies to feline kidney cells, due to the inclusion of feline kidney cell proteins in the vaccine, the substrate on which the vaccine viruses are propagated.

After much debate, a state court in California struck down the 2003 West Hollywood ordinance banning declawing.

Li et al showed that the gene that codes one of the two proteins that dimerize to form the sweet-taste receptor is nonfunctional in the cat, thus preventing the normal functioning of the sweet-taste receptor in cats.

The fall 2005 AAFP annual conference drew a record crowd of almost 600.
and Clone (GSC), the premier commercial pet cloning company today. "CC", the kitten, is reportedly alive and well at the time of this writing. By 2004, GSC delivered the first cloned cat for a paying client. Today, gene banking of client-owned pets is becoming more common. Chromatin transfer has replaced nuclear transplantation, which produced unpredictable results, and is reportedly a more efficient technique.

Cloning raises serious ethical questions, and both supporters and opponents have voiced concerns. With annual euthanasia rates of healthy homeless cats in the U.S. estimated to be between 3 and 4 million, opponents fear that cloning of cats could add to those figures. They also express concerns over any suffering that surrogate cats might endure while undergoing the embryo transfer process, gestation, and birthing. They also are apprehensive about the health of the cloned individual, although cloned cats do not seem to share the health problems associated with cloning of other species. Those who oppose cloning feel that bereaved owners of deceased pets are being exploited emotionally and financially by companies who might lead them to believe that their new cloned pet will be just like their late beloved pet.

Supporters contend that cloning serves a social purpose, and may even heighten the status of cats because demand for cloning demonstrates how highly many people regard their animal companions. Supporters also state that cloning will add to the knowledge of reproductive physiology, which can be transferred to the successful cloning of endangered species.

GSC claims to provide full disclosure to their clients to prevent them from forming unrealistic expectations. The company also claims to be lowering the feline overpopulation problem since all donor eggs are obtained from spay clinics, which they compensate, thus enabling the sterilization of more animals. GSC also confirms that surrogate mothers are unwanted, unspayed, healthy female cats whom are eventually adopted into homes.

**Selected Advances in Feline Research**

**The Feline Genome Project**

Genetic advances have led many areas of scientific research, and the cat has not been ignored. The Feline Genome Project was initiated in 1982. Since that time a dense gene map has been produced, and work on the creation of the whole genome sequence of *F. catus* is underway. The ramifications of findings in this area of science can only be imagined at this time. Understanding the molecular basis of disease etiologies or designing treatment based on an understanding at the molecular level opens a whole new paradigm of veterinary medicine.

**Obesity**

The prevalence of obesity in cats is increasing rapidly. Obesity is currently the most common feline nutritional disorder in the U.S., with estimates ranging from 19-40 percent; the prevalence is similar in many other developed countries. The cause of increased obesity in the feline population is most likely multifactorial. Although the benefits of neutering are numerous, doing so causes a slowing of metabolism, and if caloric intake is not reduced or activity level increased appropriately after neutering, weight gain ensues. Other factors include a sedentary lifestyle, such as that coupled with indoor living, and free access to highly palatable, energy-dense food. No matter what the initiating factors are, the end result is that caloric intake exceeds energy expenditure, resulting in weight gain.

Obesity in cats has been associated with an increased risk in the development of multiple health problems, including lameness, diabetes mellitus, and nonallergic skin conditions. Impaired glucose tolerance and abnormal insulin response to glucose has been documented in obese cats, and may play a role in the development of diabetes mellitus.

Even though risk factors of obesity in cats have been identified, it is still one of the most challenging disorders that veterinarians must treat. The most important factor in achieving success is committed owners who are dedicated to improving their cat's health and who will comply with the prescribed weight reduction plan.

**Veterinary Organizations**

**American Association of Feline Practitioners**

The American Association of Feline Practitioners (AAFP) was founded in 1970. The organization struggled for several years until Dr. Barbara Stein, an internationally recognized feline clinician from Chicago and former advisory board member of the Cornell Feline Health Center, actively took charge in 1973. Joining Stein in organizing the fledgling organization was Dr. Fred Scott, who was simultaneously founding the Cornell Feline Research Laboratory, and Dr. William Hardy, Jr., an active researcher of FeLV. The AAFP's mission was to raise the status of feline medicine and surgery among practitioners by sharing knowledge and sponsoring continuing education for feline practitioners. The organization began sponsoring continuing education conferences which have grown in length and attendance over the years. The AAFP had a presence in *Feline Practice*, a professional journal for feline practitioners, and continued expanding its activities by establishing student chapters and strengthening the relationship with the Cornell Feline Health Center. In 1995, the AAFP supported the establishment of board certification in feline practice by the American...
Board of Veterinary Practitioners (ABVP). As of 2005, there were 74 ABVP feline diplomats.

Today, the AAFP has over 2,000 members from 25 countries. The organization authors practice guidelines and position statements covering diverse topics. *Feline Practice* ceased publication in 2000, but in 2002, the AAFP joined forces with the European Society of Feline Medicine in the publication of *The Journal of Feline Medicine and Surgery*, a peer-reviewed professional journal featuring original research and case reports. The AAFP also provides grants for feline-oriented research, and has a strong presence on the Veterinary Information Network (VIN), an online web-based information resource for veterinarians. The AAFP is committed to growing stronger and to continuing its mission of raising the standard of feline medicine and surgery.

**Cornell Feline Health Center**

Although a program to study feline infectious diseases was started in 1964 by Dr. James Gillespie at the New York State Veterinary College at Cornell University, the establishment of the Cornell Feline Research Laboratory in 1974 reaffirmed the university's commitment to increasing knowledge of feline disease. Dr. Fred Scott served as the first director, supported by experts in several disciplines from within the veterinary college. In 1978, the name was changed to the Cornell Feline Health Center (CFHC), but the mission of the organization has remained constant for over 30 years: to improve feline health by supporting feline research. This was a novel undertaking at a time when other feline organizations were essentially cat clubs focused on cat shows and breeding. The British Small Animal Veterinary Association provided scientific advice to the new organization and supported the ideals of FAB. In the 1960's, FAB awarded its' first research fellowship and soon thereafter started offering clinical scholarships in feline medicine.

In 1980's, FAB established the **European Society for Feline Medicine** (ESFM) to provide European veterinary surgeons with information and continuing education on feline medicine. Today, the ESFM and the AAFP share responsibility for the publication of *The Journal of Feline Medicine and Surgery*. Together, FAB and the ESFM sponsor annual continuing education congresses for veterinarians, and host other educational events throughout the year for both cat owners and veterinarians. FAB publishes information covering topics ranging from cattery construction and management to feline infectious diseases, spanning the bridge between the veterinary profession, cat owners, breeders, and cattery managers.

**Feline Research**

Prior to 1962, an average of 3 scientific articles were published annually on feline health. Feline research became established in the mid 1970's, remained stable throughout the next decade, then increased significantly by the late 1980's. Unfortunately, funding for feline studies is difficult to obtain, with no government support unless the research has applicability to human medicine. Fortunately, numerous private organizations support veterinary studies, and their generosity has helped increase understanding of feline health and disease (Appendix I).

**Summary**

Cats have finally garnered the attention they deserve in veterinary medicine, however, there is still much to learn about this unique species and new challenges surface daily. For example, at the time of this writing, world veterinary and health officials are closely monitoring avian influenza in cats. This paper has highlighted only some of the people and institutions that have contributed to the advancement of feline medicine. Interest in feline medicine is at an all-time high, and the future appears promising for cats as more veterinarians, researchers, and organizations increase their focus on felines.

**References available upon request**

The author wishes to thank Dr. Fred W. Scott, Professor Emeritus, Cornell University College of Veterinary Medicine (CUCVM), and Dr. James R. Richards, Director, Cornell Feline Health Center for generously sharing their knowledge of feline medicine; Ms. Nina Camuti-Danielson, New Jersey, for reminiscing about her father; and Mr. Michael Friedman of the Flower-Sprecher Veterinary Library at CUCVM for his patient assistance in retrieving reference materials.
This retrospective study was performed to review and characterize urinary tract infections in diabetic cats. A review was made of the medical records of 141 diabetic cats that had had urine obtained for culture by antepubic cystocentesis and that had not been treated with antibiotics, undergone urinary tract catheterization or urinary tract surgery within 2 weeks of urine collection or had urethral obstruction at the time of urine collection. Urinary tract infection was identified in 18 of 141 diabetic cats. *Escherichia coli* was the most common isolate (67 percent). Female cats were at increased risk (prevalence odds ratios [POR], 3.7; 95 percent confidence interval [CI], 1.3 to 10.2; P = 0.013). Clinical signs of lower urinary tract disease and findings on urine sediment examination were good predictors of positive urine cultures. The authors conclude that urinary tract infections are common in diabetic cats regardless of status of diabetic control, suggesting routine monitoring with urine sediment exams or urine culture is warranted.


An 8-year-old, spayed female, domestic shorthair cat with a history of hyperthyroidism, anorexia, dehydration, cervical ventroflexion, and behavioral changes was referred to the Iowa State University College of Veterinary Medicine. The cat was obtunded, with severe dehydration (15 percent) and hypothermia (86 degrees F), and severe muscle atrophy and fasciculations. Serum biochemical abnormalities included severe hypernatremia (195 mmol/L, reference interval 155-165 mmol/L), hyperchloridaemia (161 mmol/L, reference interval 123-131 mmol/L), and hypokalemia (3.6 mmol/L, reference interval 4.0-5.7 mmol/L). Calculated osmolality was 418 mOsm/kg (reference interval 280-305 mOsm/kg), attributable to the hypernatremia. The cat was kept warm and given fluid and glucocorticoid therapy and supportive measures but remained unresponsive. Hypernatremia and hyperosmolality improved through day 3, when the cat died suddenly. At necropsy, a 1.25-cm mass was found in the area of the thalamus and interthalamic adhesion that extended to the ventral aspect of the cerebrum. The histologic and immunohistochemical diagnosis was B-cell lymphoma. Hypernatremia and hyperosmolality in this cat were attributed to primary adipsia and hypothalamic dysfunction secondary to effacement of central nervous system tissue by neoplastic lymphocytes. To the authors' knowledge, this is the first reported case of lymphoma in animals limited to the thalamus and hypothalamus, with no involvement of the spinal cord.


Obesity is a new pandemic in humans associated with increased morbidity and mortality. A similar sharp increase has occurred in the number of obese cats in recent years. There are many reasons for this increase in both species; for cats, the main problems are unlimited access to a nutrient-dense diet and sedentary life style. Obesity is a major risk factor for diabetes whose prevalence has increased concomitantly. Cats develop a form of diabetes that is similar to type 2 in humans, characterized by islet amyloid and loss of beta-cell mass. The energy metabolism of cats and the pathophysiology of obesity and diabetes are being characterized in order to identify similarities and differences from humans and to recognize causative and protective factors for adverse sequelae to obesity and diabetes. New approaches to the study of lipid and glucose metabolism in cats show that glucose metabolism is not as dissimilar and lipid metabolism is not as similar to that of humans as previously thought, perhaps explaining why cats do not develop the classic metabolic syndrome. The author concludes that the cat is an excellent model for examining the pathophysiology and complications of obesity and diabetes.
Appendix I: Feline Organizations

AMERICAN ASSOCIATION OF FELINE PRACTITIONERS
 Funds general feline research as well as an annual topic-specific research project.

CORNELL FELINE HEALTH CENTER
 Sponsors feline research. Projects supported in 2005 included such diverse topics as radiation therapy, analgesia, virus-host interactions in calicivirus, and the bioavailability of glucocorticoids in cats.

FELINE ADVISORY BUREAU
 Supports studies of feline diseases, and funds educational posts and feline medicine residencies at several universities in the United Kingdom.

MORRIS ANIMAL FOUNDATION
 Has supported veterinary studies for over 55 years. In 2006, the foundation pledged $4 million for animal health studies, with 10 percent of that amount earmarked for feline studies.

WINN FELINE FOUNDATION
 Established by the Cat Fanciers' Association in 1968. The foundation funds feline medical research, granting over $2.5 million dollars since its inception.

OTHER
 Smaller private foundations typically support study of single diseases. For example, the Orion Foundation supports FIP investigations. Also, pharmaceutical and pet food companies fund their own investigations that are designed to bring better feline products to the market, but many of these studies also benefit cats in a more general way.


Companion animal staphylococcal isolate antibiograms were screened retrospectively to determine the frequency of methicillin-resistant (MR) infection by *Staphylococcus aureus*, *Staphylococcus intermedius*, and *Staphylococcus schleiferi*. Rates of MR were: *S. aureus* 35 percent, *S. intermedius* 17 percent, and *S. schleiferi* 40 percent. Frequency of isolation of methicillin-resistant *S. aureus* (MRSA) from dogs and cats was similar, whereas methicillin-resistant *S. intermedius* (MRSI) and methicillin-resistant *S. schleiferi* (MRSS) were significantly more common in dogs. MRSS was more commonly associated with deep infections. The MR strain resistance pattern to other classes of antibiotics was also investigated. MRSA was resistant to most classes of antibiotics, followed by MRSI, while MRSS maintained the most favorable susceptibility profile. MR staphylococci may pose a significant risk to animal and public health. Therefore, to avoid selecting for resistant strains in cases of suspected staphylococcal infection, clinicians should consider culture and susceptibility testing early in the course of treatment.

In a survey of United Kingdom veterinary practitioners, 96 percent indicated that they performed ovariohysterectomy on cats via flank laparatomy rather than a midline coeliotomy. At a veterinary teaching hospital, 32 cats were spayed by the midline approach and 34 by the flank approach by undergraduate students under the continuous supervision of a veterinary surgeon. The duration of each part of the procedures was recorded and information was obtained from the students, the supervisors and the owners of the cats by means of questionnaires. The total duration of the surgery and the students' assessment of the difficulty of the surgery were not significantly different between the two groups. The time taken from the skin incision to entering the peritoneum was significantly longer with the flank approach, but finding the uterus took significantly longer with the midline approach. There was a high incidence of wound complications in the form of swelling, redness or discharges, but the only statistically significant difference between the groups was a greater incidence of discharges in the cats spayed via the flank (five cases) than in the cats spayed via the midline (one case).