From wildcat, to farm-hand, to deity, to laser chaser: A look at the domestic house cat

by Tristan Mula

This paper examines the journey of the domestic house cat, from its wild origins to its current status as a beloved companion. By delving into domestication, morphology, global dispersal, and cultural significance, the paper sheds light on the intricate relationship between humans and cats throughout history. The research explores the domestication timeline, highlighting key findings such as discovering ancient cat burials in Cyprus and Egypt and identifying the wildcat species *Felis silvestris lybica* as the ancestor of modern domestic cats. Additionally, it discusses the challenges researchers face in distinguishing between wild, feral, and domestic cat remains due to their similar genetic makeup and limited morphological changes over time. Furthermore, the paper investigates the role of cats in ancient societies, emphasizing their significance as symbols of divinity in ancient Egypt and their use in pest control during the Roman Iron Age. It also examines recent technological advancements, such as medical imaging, which have facilitated the study of cat mummies and provided insights into ancient mummification practices. Overall, researchers comprehensively explore the domestication, cultural significance, and morphological evolution of the domestic house cat, highlighting its enduring importance in human society.

> HEAR and attend and listen; for this befell and behappened and became and was, O my Best Beloved, when the Tame animals were wild. The Dog was wild, and the Horse was wild, and the Cow was wild, and the Sheep was wild, and the Pig was wild—as wild as wild could be—and they walked in the Wet Wild Woods by their wild lones. But the wildest of all the wild animals was the Cat. He walked by himself, and all places were alike to him. (Kipling 1902)

The most distinguishing, appealing, and frustrating trait of the domestic cat (*Felis catus*) is how distant and evasive they can be. The house cat is the most widely-owned pet in the world despite its unpredictable behaviors, beating out man's best friend the dog (Serpell 2013). Today the cat is still as free-spirited as its great ancestors, so how did such an elusive animal move into our homes and hearts? This paper provides an overview of research findings concerning the domestication, morphology, global dispersal, and the commercial and cultural significance of the domestic cat. It will also cover a few of the challenges researchers face when following the phylogeny of cat domestication vis-à-vis other popular domestic animals like dogs and cattle. Selective breeding and genetic exchange through interbreeding have resulted in physical similarities between domestic cats and their wild ancestors. By looking at the morphology of archaeological cat remains and genetic changes through ancient DNA sampling of cat remains, this paper will shed light on how the relationship between humans and cats evolved: how the domestic cat went from a wild apex predator to a furry housemate.

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When were cats domesticated? The zooarchaeological data on domestic cats is minimal. At least some wildcats are believed to have begun to live close to human settlements around the time that early societies in Western Asia started to focus on agriculture–around 11,000 years ago during the pre-pottery Neolithic period (American Association for the Advancement Of Science 2004). However, no remains have been discovered to confirm or deny this hypothesis. It is commonly believed that the Egyptians, around 5000 years ago, were the first to tame cats, evidenced by the abundance of cat depictions in Egyptian iconography (Geigl and Grange 2019). However, while cats held significant cultural status in Egypt, they may not have been the first to domesticate them (Linseele, Van Neer, and Hendrickx 2007). Evidence of cat domestication predating Egyptian civilization comes from a 9500-year-old tomb on the Mediterranean island of Cyprus, where a Neolithic child was buried alongside a cat; this finding predates Egyptian iconography and suggests early cat domestication on the island (Rothwell 2004). There is no evidence of cats inhabiting the island of Cyprus before 7,500 BC (Rothwell 2004), suggesting that cats were not native to the region during that period. The most plausible explanation for the presence of a cat in the tomb is that it was brought to the island by farmers who traveled by boat (Serpell 2013). This indicates the existence of early maritime connections and trade networks, with cats likely serving practical purposes like pest control aboard ships. Additionally, including the cat in the child's burial may reflect some type of significance held by cats in the daily lives or beliefs of the community (Geigl and Grange 2019). Within this tomb, the cat was deliberately buried only 40 cm away, and the body showed no sign that it was butchered; the cause of death is unknown. Each of their bodies was aligned symmetrically, and both heads faced the same direction. The way both bodies align might indicate a close bond between the two or that the cat held some level of significance to the child or family (Geigl and Grange 2019).

Another significant find for the earliest evidence of cat domestication comes from the Egyptian city of Hierakonpolis, Egypt being a country famous for its cat tamers (Van Neer et al. 2014). Hierakonpolis was home to a sizable Pre-dynastic site rich with archaeological fauna and flora. The city has many ancient domestic houses and cemeteries. In the 1970s, an upper-class cemetery known as HK6 was excavated, with work ongoing to this day (Van Neer et al. 2014). Animals were rarely found within human graves; however, recent archaeological excavation has revealed numerous animal graves linked to the primary tombs of elite individuals (Tristant et al. 2011). These elite burials, centrally positioned within mortuary complexes, were encircled by smaller graves—presumably those of relatives and court officials—and a variety of domestic and wild animals. These animals were deliberately interred in separate graves, either alone or in groups of the same species, with occasional instances of burial alongside human remains. Evidence of butchered domestic animal remains, likely offered as food, has also been found but is not considered part of the animal burial practices (Linseele, Van Neer, and Hendrickx 2007). Discovered within the many animal graves was a pit of six fully intact cat remains (Van Neer et al. 2014). Through dental and epiphyseal analysis, it was determined that there were four kittens and two adult cats. One of the oldest cats had complete epiphyseal fusion, meaning it was at least 11 months of age at death (Van Neer et al. 2014). Researchers sought to determine whether these were domesticated cats or wildcats (Linseele, Van Neer, & Hendrickx 2007), which can be a

challenge as wildcats and domestic cats have a similar genetic makeup, providing very few differences in their physiology, morphology, and behavioral patterns (Ottoni et al 2017). To do so, they looked at research on ancient and modern domestic cat morphology (discussed below). Using the mandibles, Van Neer and colleagues (2014) found that at least one of the male adult cats from the Hierakonpolis site was domestic.

The discovery of the earliest known domestic cat establishes that cats have been held in high importance for millennia, but whence did the species *Felis catus* arise? Researchers first needed to find out from which wildcat species *Felis catus* originated. Ancient DNA (aDNA) sourced from bones, teeth, hair, and skin samples, from 200 cat mummies in Egypt was analyzed. Alongside DNA from 352 ancient cat museum samples—both extant and extinct species. These were then compared with DNA from modern wild, feral, and domesticated cats (Geigl and Grange 2019). Using aDNA posed challenges for researchers since aDNA has poor preservation in hot, dry climates like Egypt. To overcome the minimal aDNA available, they used Polymerase Chain Reaction (PCR), which is a technique used to make many copies of limited DNA (Geigl and Grange 2019). This was done in a contaminant-free lab at the University of Leuven and at the Jacques Monod Institute (Geigl and Grange 2019). Five wildcat species from across the Old World were examined for comparative purposes: the European *Felis silvestris*, the African wildcats *Felis silvestris lybica* and *Felis cafra*, and two Asian wildcats, *Felis ornata* and *Felis bieti*, which are also known as the Chinese mountain cat (Smith 2017). After genetic analysis of the aDNA, modern DNA, and short tandem repeats (STR), it was determined that the domestic cat originates from the wildcat known as *Felis silvestris lybica* from North Africa (Ottoni et al. 2017).

According to Ottoni et al. (2018), tracing the domestication origins of the wildcat *Felis silvestris lybica* is challenging compared to other domesticated animals because there is little evidence left in the zooarchaeological record and most of it is depicted through the iconography of Pharaonic Egypt (Ottoni et al. 2017). The initial objective of the researchers was to identify the most straightforward paths of domestic cat dispersal across Europe, focusing on the continent's primary shipping and trading routes. Unlike dogs and farmyard animals, a wildcat's behaviour is solitary and territorial, meaning they do not necessarily attach themselves to humans but rather to the territory that they occupy and in which they hunt (Ottoni et al. 2017). It is a common belief that a mutualistic relationship led to cat domestication (Ottoni et al. 2017), where cats started to cohabitate spaces with humans when humans shifted from a nomadic lifestyle and focused on agriculture and producing cereal crops. According to this theory, the storing and shipping of such crops, such as wheat and other grains, led to a dispersal of rodents across Europe and the cats followed the rodents (Ottoni et al. 2017).

An interesting study looked at the increase of cat remains found in archaeological layers from medieval Denmark, which coincide with the first introduction of black rats to this part of Europe (Yu et al. 2022). Many of these early black rat remains are highly concentrated in coastal towns, suggesting that they came over as unwelcome passengers on trading ships from sub-continental Asia ports (Yu et al. 2022). To help combat the rodent populations, cats may have been brought on these ships as well (Bitz-Thorsen and Gotfredsen 2018). Throughout the Medieval period, it was mandatory to have cats on ships

during times of war and trade (Ottoni et al. 2017). This was confirmed by the discovery of feline remains from an Egyptian lineage of wildcat found at the Viking port at Ralswiek (7th–11th centuries AD) (Yu et al 2022). Researchers tracked the dispersal pattern of these ancient black rats (Rattus rattus) who came from India and spread across the globe (Yu et al. 2022). Zooarchaeologists studied the mitochondrial haplogroups from aDNA from 67 ancient black rats collected from museum collections across Europe, the United States, and Africa, as well DNA from 135 modern black rats who were trapped and euthanized (Yu et al. 2022). When comparing the results of the rat research and the dispersal patterns of the medieval cat remains, both animals follow a near identical pattern of dispersal aligning with early trade routes (Yu et al. 2022).

Determining when wildcats and feral cats transitioned into domestic cats poses a challenge because their physical appearance has primarily remained consistent, with minor size variations (Linseele, Van Neer, and Hendrickx 2007; Bitz-Thorsen and Gotfredsen 2018). This similarity complicates the differentiation of remains between wildcats, feral cats, and domestic cats. Unlike dogs, which have been selectively bred for millennia (Galibert et al. 2011), cats have evolved primarily through natural selection, with few exceptions like designer breeds (Driscoll et al. 2009). A study examining *Felis catus* remains from Viking-age Denmark compared to modern cats revealed that wildcats were no longer present in Denmark by the Early Roman Iron Age circa the first century AD (Bitz-Thorsen and Gotfredsen 2018). This research uncovered subtle yet intriguing changes in cat morphology over time. Notably, some domestic cats have grown larger than their wild ancestors, such as *Felis silvestris lybica* subspecies (Ottoni et al. 2017).

What is particularly unusual is that some domestic cats, as domesticated animals, tend to become smaller over time as breeding focuses on maintaining the juvenile characteristics that most people find to be more attractive to an animal. The focus on juvenile features is most observable in the change from wolf to domestic dog, but it is also seen in cattle (Manning et al. 2017). Since the Neolithic, the cow has reduced in size by approximately 33% (Manning et al. 2017). A meta-analysis by Bitz-Thorsen and colleagues (2018) found that the most significant morphology change was in the cat's limb bones and mandible. In comparing the limb bones of cats excavated from Overgade, Odense, Denmark (c. 200 AD) to modern cats, they found that modern cat limb bones increased in length by 16%. The team also looked at cats from post-medieval times and found modern cats to have increased in size by 4% (Bitz-Thorsen & Gotfredsen 2018). Zooarchaeologists could rule out sexual dimorphism as a cause for the size increase in cats by looking at modern female and male domestic and wild cats (Bitz-Thorsen and Gotfredsen 2018). Wildcats exhibited sexually dimorphic variation in cranial vault metrics. There was little to no sexual dimorphism in domestic cats other than small "morphometric characteristics on the pelvis and mandible" (Bitz-Thorsen and Gotfredsen 2018:244). Following the domestication and dispersal of cats in Europe, we move back in time to the Roman period. *Felis catus* was most likely introduced as a new working pet during the Roman Iron Age (1st–2nd centuries AD), and few bones have been found in contemporary farming communities, lending evidence to the hypothesis that cats were domesticated as rodent controllers (Yu et al. 2022). Denmark's first zooarchaeological find of a domesticated cat was from a human cremation grave in Kastrup, Southern Jutland, from the late Roman Iron Age, circa 200 AD (Bitz-Thorsen

and Gotfredsen 2018). The grave consisted of cat and sheep astragalus bones with visible cut and drill marks, indicating that they were possibly worn together as an amulet. The discovery of cat remains used in fashion was not an unusual find, as research has shown that during the Roman Iron Age and Viking Age, cat pelts were widely traded (Bitz-Thorsen and Gotfredsen 2018). Bitz-Thorsen and Gotfredsen (2018) examined the faunal remains collected in a bone pit at a possible pelt production site in Overgade, Odense, Denmark, where they discovered that out of the mammal bones discovered, 83.5% were cat (contributing to a minimum number of individuals [MNI] of 70). Analyzing the bones showed clear cut marks around the cat's nose and neck bones, suggesting that they were removed from the body, leading the researchers to believe that the cats were used for their pelts (Bitz-Thorsen and Gotfredsen 2018). By observing long bone epiphyseal fusion, it was determined that most cats at the Overgade site had also been killed before reaching one year. The older cat skeletons were believed to females used for breeding.

Cats were not just valued for their pelts; they were also held in high standing as deities or vessels for gods in many cultures worldwide (Yuko 2021). Cats' high value and importance was never more evident for zooarchaeologists and archaeologists than in the physical and iconographic remains of cats from Pharaonic Egypt. Egyptians viewed cats as the vessels of their gods. Affluent families would dress their cats in gold and jewels, and when their beloved pet passed, they would be mummified to keep their bodies intact for the long journey across the river Styx (Yuko 2021). New technologies have been adopted by zooarchaeologists when studying these discovered mummies, such as X-ray radiography, computed tomography (CT) and, on occasion, magnetic resonance imaging (MRI), which is replacing the original X-ray radiography of the early twentieth century (Gagne et al. 2018). These new technologies have opened up opportunities for 3D imaging and 3D printing of these ancient remains (Gagne et al. 2018). With this new technology came the disappointing discovery that many of the animal mummies were empty, now known as pseudo-mummies; thus, zooarchaeologists can use these new technologies to see if they have a real or a pseudo-cat mummy (Gagne et al. 2018).

These technologies were used on a mummified cat that came into the hands of Musée des Beaux-Arts de Rennes in 1923 (Gagne et al. 2018). Multiple 2D images were taken and stacked to construct a 3D model of the mummified cat's torso and head region. They discovered that this mummy was lacking its cranium and mandible. In the body of the mummy they discovered that the collection of the bones in the body cavity contained an MNI of three cats. The bones within the body were not in anatomical position, which suggested to researchers that the cat remains had already decomposed; this was confirmed with the finding of little holes within the bones that looked to be caused by necrophagous insects. This research concluded that this cat mummy was a pseudo-mummy.

Not all cat remains found from ancient Egypt have been debunked as fakes. Mummies have been found in honour of the goddess Bastet across Egypt (Zivie and Lichtenberg, 2005). One site, Bubasteion of Saqqara, a sanctuary for Bastet studied for over 20 years, is home to a large cat catacomb. The cat mummies within the Bubasteion of Saqqara are placed in intricately carved cases; one of the most striking at this cemetery is the case found in the tomb of Tutankhamun's wet nurse, Lady Maia. Most

mummies discovered in these cat catacombs were packed and shipped across Europe for further examination in the 1980s (Zivie and Lichtenberg, 2005). Led by Leonard Ginsburg at the Museum of Natural History in Paris, many of the cat crania were examined to determine the wildcat species from which they originated; it was hypothesized to be *Felis silvestris lybica*, though it is impossible to know for sure as most mummies remain wrapped and DNA samples could not be taken (Zivie and Lichtenberg, 2005). Within these tombs, cat mummies were wrapped in two very distinct ways: one was wrapped with the cat's front legs close to its body and the back legs brought up (these become known to researchers as "skittle cats"), and the second, less common wrapping method involves wrapping the legs, tail, and even the ears, separately, giving a cat its more true appearance (Zivie and Lichtenberg, 2005). The aging of these mummies was done by analyzing body size (i.e., limb length) through X-rays and 3D imaging. Small cat mummies were radiographed in groups ranging from three to six as well as photographed alone. The X-ray film and photos were then developed and viewed and have been studied over the years (Zivie and Lichtenberg, 2005).

Even at this site, many pseudo-mummies were discovered. These fake offerings might explain the pseudo-mummy from the Musée des Beaux-Arts de Rennes. One theory for the existence of pseudo-mummies is that the high demand for cat mummies exceeded the supply rather than an intentional act of deception (Ikram 2005). Methods of cat mummification are relatively unknown as there is no written record yet of the process; there are only images left behind and stories passed down through the years (McClung Museum of Natural History and Culture 2020). One thing that is known is that these animals were given the highest honor: to live forever with their human counterparts (Ikram 2015).

Today, cats live in one of every three households, and more than 600 million cats coexist with people globally (Driscoll et al. 2015), despite cats retaining some of their wild traits and morphology. Cats have proven themselves to be commercially, spiritually, and emotionally important sidekicks to humans for at least the last 9,500 years. They may still look much like their wildcat predecessors, though just a bit better fed, but the cat “still walks by himself, and all places are alike to him” (Kipling 1902). Only time will tell where these apex predators will go next.

References Cited

American Association For The Advancement Of Science. 2004. Oldest known evidence of cat taming found in Cyprus. *ScienceDaily*. www.sciencedaily.com/releases/2004/04/040409092827.htm (accessed October 13, 2022).

Bitz-Thorsen, Julie, and Anne Birgitte Gotfredsen. 2018. Domestic cats (*Felis catus*) in Denmark have increased significantly in size since the Viking Age. *Danish Journal of Archaeology* 7(2):241–254. https://doi.org/10.1080/21662282.2018.1546420.

Driscoll, Carlos A., Juliet Clutton-Brock, Andrew C. Kitchener, and Stephen J. O'Brien. 2009. The taming of the cat. *Scientific American* 300(6):68–75.

Driscoll, Carlos A., Juliet Clutton-Brock, Andrew C. Kitchener, and Stephen J. O’Brien. 2015. How house cats evolved. *Scientific American*, September 1. https://www.scientificamerican.com/article/how-house-cats-evolved/.

Gagne, Ronan, Stéphanie Porcier, Théophane Nicolas, François Coulon, Odile Hays, and Valérie Gouranton. 2018. A digital introspection of a mummy cat. Paper presented at the 2018 3rd Digital Heritage International Congress (DigitalHERITAGE) held jointly with 2018 24th International Conference on Virtual Systems & Multimedia (VSMM 2018), San Francisco, October 26–30. https://doi.org/10.1109/digitalheritage.2018.8810049.

Galibert, Francis, Pascale Quignon, Christophe Hitte, and Catherine André. 2011. Toward understanding dog evolutionary and domestication history. *Comptes Rendus Biologies* 334(3):190–196. https://doi.org/10.1016/j.crvi.2010.12.011.

Geigl, Eva-Maria, and Thierry Grange. 2019. Of cats and men: ancient DNA reveals how the cat conquered the ancient world. In *Paleogenomics: genome-scale analyses of ancient DNA*. Charlotte Lindqvist and Om P. Rajora, eds. Pp. 307–324. Population Genomics. Cham, Switzerland: Springer. https://doi.org/10.1007/13836_2018_26.

Kipling, Rudyard. 1902. The cat that walked by himself. *Just So Stories* (Lit2Go Edition). https://etc.usf.edu/lit2go/79/just-so-stories/1296/the-cat-that-walked-by-himself/ (accessed October 22, 2022).

Linseele, Veerle, Wim Van Neer, and Stan Hendrickx. 2007. Evidence for early cat taming in Egypt. *Journal of Archaeological Science* 34(12):2081–2090.

Manning, Matthew, Susanne Garvis, Christopher Fleming, and Gabriel T. W. Wong. 2017. The relationship between teacher qualification and the quality of the early childhood education and care environment. *Campbell Systematic Reviews* 1. https://doi.org/10.4073/csr.2017.

McClung Museum of Natural History & Culture. 2020. Cat mummies. https://mcclungmuseum.utk.edu/2001/05/01/cat-mummies/.

Ottoni, Claudio, Wim Van Neer, Bea De Cupere, Julien Daligault, Silvia Guimaraes, Joris Peters, Nikolai Spassov et al. 2017. The palaeogenetics of cat dispersal in the ancient world. *Nature Ecology & Evolution* 1(0139). https://doi.org/10.1038/s41559-017-0139.

Rothwell, Tom. 2004. Evidence for taming of cats. *Science* 305(5691):1714–1714. https://doi.org/10.1126/science.305.5691.1714.

Serpell, James A. 2013. Domestication and history of the cat. In *The domestic cat: the biology of its behaviour.* 3rd edition. Dennis C. Turner and Patrick Bateson, eds. Pp. 84–100. Cambridge: Cambridge University Press.

Smith, C. 2017. Cats domesticated themselves, ancient DNA shows. *National Geographic*, March 15. https://www.nationalgeographic.com/science/article/domesticated-cats-dna-genetics-pets-science (accessed October 12, 2022)

Tristant, Yann, Morgan De Dapper, Sandra Aussel, and Béatrix Midant-Reynes. 2011. Cultural and natural environment in the eastern Nile Delta: A geoarchaeological project at Tell el-Iswid (South). In *Egypt at its origins, vol. 3: Proceedings of the Third International Colloquium on Predynastic and Early Dynastic Egypt, the British Museum, London, 27th July–1st August 2008.* Renée F. Friedman and Peter N. Fiske, eds. Pp. 157–191. Orientalia Lovaniensia Analecta 205. Leuven, Belgium: Peeters.

Van Neer, Wim, Veerle Linseele, Renée Friedman, and Bea De Cupere. 2014. More evidence for cat taming at the predynastic elite cemetery of Hierakonpolis (Upper Egypt). *Journal of Archaeological Science* 45:103–111. https://doi.org/10.1016/j.jas.2014.02.014

Yu, He, Alexandra Jamieson, Arden Hulme-Beaman, Chris J. Conroy, Becky Knight, Camilla Speller, Hiba Al-Jarah et al. 2022. Palaeogenomic analysis of Black Rat (Rattus rattus) reveals multiple European introductions associated with human economic history. *Nature Communications* 13 (2399). https://doi.org/10.1038/s41467-022-30009-z

Yuko, Elizabeth. 2021. How cats became divine symbols in ancient Egypt. *History*, August 9. https://www.history.com/news/cats-ancient-egypt (accessed October 13, 2022).

Zivie, Alain., and Lichtenberg, Roger. 2005. The cats of the goddess Bastet. In *Divine creatures: Animal mummies in ancient Egypt* (pp. 106–119). Cairo: Cairo Press.