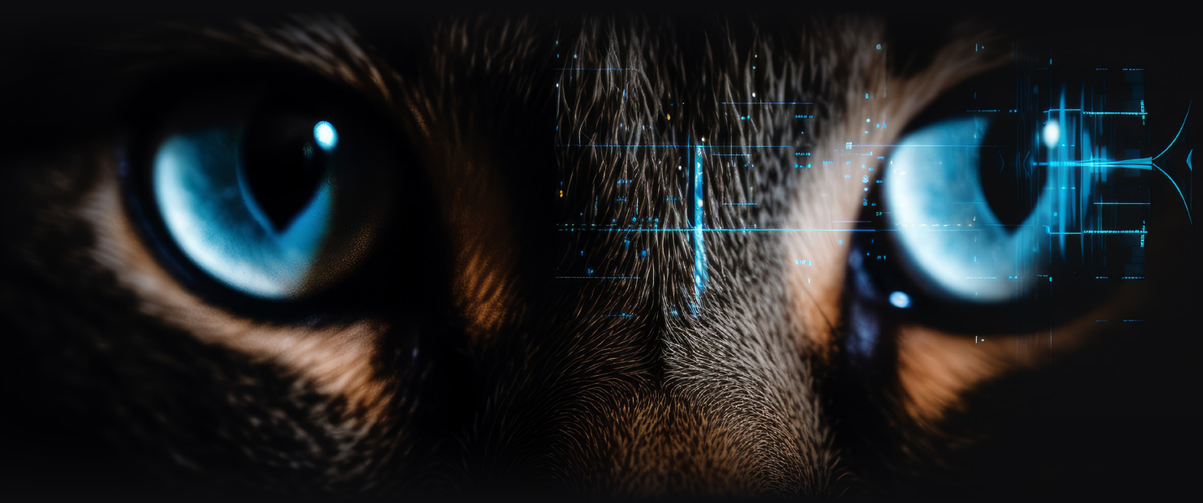
The feline enigma: exploring the origins, dispersal and evolution of domestic cats



Among domestic animals, cats are probably the most enigmatic, to the extent that one would even argue whether they are domestic at all. Useful pest-control agent, companion animal and iconic celebrity of the internet in modern society, the cat has a strong and intimate bond with humans, which is the key to its evolutionary success.

Archaeozoological evidence suggests that the relationship between cats and humans most likely started in the Near East more than 10 000 years ago, during the Neolithic, when wildcats were attracted to human settlements of the first sedentary communities as scavengers and following the arrival of anthropogenic commensal rodents (rats and mice). Egypt may have been a second, later centre of cat domestication, probably as early as 3 700 years ago.

This picture was further enriched by the DNA analysis of modern and ancient cats, which showed that domestic cats originated from the Near Eastern and North African wildcat, *Felis silvestris lybica*. Early domestic cats probably spread into Europe with humans from the Near East by 6 400 years ago, in a late phase of the Neolithic, and a subsequent more significant radiation out of Egypt across the Eurasian and African continent took place during Classical Antiquity, probably more than 2 500 years ago.

The behavioural features of the Near Eastern wildcat (*F. s. libyca*), more tolerant of human presence, and the cultural conditions of the Neolithic, represented the perfect mix to spark the start of the cat-human relationship. However, a stronger shift in this interaction may have occurred later in Egypt. The peculiar social and cultural context of the Egyptian society may have facilitated the evolution of a more tolerant disposition of cats towards humans through selection for docility. From pest-control agents in farming communities, cats of Egyptian households probably turned into the companions that we know today. The increasing popularity of cats among Mediterranean cultures (the Phoenicians, Carthaginians, Greeks, Etruscans, and Romans) and their usefulness on ships infested with pests presumably sparked their dispersal across the Old World from Egypt.

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However, many fundamental questions remain unresolved. The times and modes of cat dispersal, the biological processes that made them so adaptable to the human niche, and the interactions between domestic cats and other wildcat populations in Europe and Asia are yet to be fully understood. Domestic cats dispersed globally owing to their association with people and to their capacity to adapt swiftly to novel dietary niches within the human food web. In their relationship with humans across time, cats were scavengers, pest-control agents, and finally, companions enjoying the commodities (and easy access to food) of households. However, it remains still widely unexplored when and how cats shifted to novel dietary habits, such as those based on marine and cereal sources typical of present days. Our intimate bond with cats also comes with a toll, zoonotic diseases. Due to their long-shared history with humans as pest-control agents and companions, cats are renowned hosts of various pathogens, yet very little is known about the evolutionary pathways of zoonotic infections in cats.

Biomolecular archaeology offers the tools to address these unanswered questions. In particular, the technological advance in sequencing techniques of the last decade has paved the way to the paleogenomic era. Exploring at the high resolution of full genomes the genetic variation at different time points has succeeded in reconstructing evolutionary scenarios previously hardly imaginable, first and foremost for the human species.

Through cutting-edge DNA extraction and sequencing techniques, FELIX will reconstruct ancient genomes of hundreds of wild and domestic cats from the last 15 000 years across a wide geographic range encompassing the Eurasian and African continents. It will shed further light on the dispersal of cats from the Near East and Egypt during the last 10 000 years. It will seek to define to what degree domestic cats interacted with local wildcat populations upon arrival in novel areas along with humans. By opening a window onto the past genetic variation of cats in various natural and anthropogenic contexts, including ancient Egyptian mummies, FELIX will understand how cats turned into the pet that we know today.

The innovative genetic techniques applied will also make it possible to explore in cats one of the fundamental biological members of ecosystems and essential partners of living organisms, the microbial community. This will offer the chance to illustrate the patterns of pathogen infections in cats in the past and shed more light on the evolution of cat-human zoonotic infections (e.g. cat scratch and bite diseases, spotted fever, pasteurellosis).

Finally, using the chemical signatures of carbon and nitrogen recorded in the bone collagen, FELIX will track changes in the dietary habits of wild and domestic cats from the past. We will investigate to what extent cat feeding strategies changed by living in proximity to humans, for example, their potential adaptation to aquatic resources associated with dispersals across sea routes or to cereal-based resources introduced in the human dietary niche starting from the Neolithic.

The FELIX team is composed of paleo-geneticists, archaeologists, and other specialists in archaeozoology and biogeochemistry, and includes a broad international network of experts and sample providers.

FELIX
Genomes, food and microorganisms in the (pre)history of cat-human interactions

PROJECT SUMMARY

FELIX aims to unravel the intimate relationship between cats and humans. Through biomolecular archaeological methods, it seeks to understand the origins of cat domestication and the global dispersal of cats. It will examine how cats changed their nutritional behaviour as human companions and document the temporal trajectories of pathogen infections in cats, shedding light on the pathways of zoonotic diseases.

PROJECT PARTNERS

The FELIX project is based at the Department of Biology of the University of Rome Tor Vergata. The team collaborates with the Royal Belgian Institute of Natural Sciences (RBINS) and the University of Leuven (KU Leuven), in Belgium.

PROJECT LEAD PROFILE

Claudio Ottoni received his PhD in Ecology and Evolutionary Biology at the University of Rome Tor Vergata (2008). He worked as a postdoc in Belgium and Norway investigating ancient DNA in human and animal remains. He is currently associate professor of Molecular Anthropology at the University of Rome Tor Vergata. In 2021 he received an ERC Consolidator Grant to investigate cat domestication.

PROJECT CONTACTS

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