

# Introducing the Dog

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For some people, dogs are colleagues who assist them in their jobs; for mavericks, they represent wolves, true reminders of the wilderness, and for city-dwellers, dogs may appear as demanding children, in need of constant care and devotion. There are many ways in which humans relate to these four-legged creatures . . . and, indeed, dogs come in so many shapes and forms that it is no wonder that people may sometimes get confused about the different roles they play.

In this book, we portray the dog both as an animal with a unique evolutionary history and as man's (and woman's) best friend. Our task has not been an easy one. There are so many expectations: Everyone, even those who are not dog owners, seems to be an expert on dogs. And the myriad of wonderful and heart-warming stories and anecdotes about them often hinder our objectivity.

There are many ways to characterize humans' relationship with dogs, especially the family pets with which many of us share our gardens, apartments, or even beds. People have the right to show their emotions when referring to their pet or companion dog as "my darling" or "my sweetheart," but science should also have its say. Dogs need to be respected as a species with its own destiny and allowed to be what it has become: a dog. Thus, respecting a dog as a friend is perhaps the best approach to the human-canine relationship. Friends can be attached to each other for all their lives but they are also able to lead independent lives for a shorter or longer time if circumstances require it. They help each other but do not expect an immediate return for favors. Friends enjoy being together just for the sake of it, but they also respect one another, allowing each other to develop independent personalities.



**Right** Joint activities contribute to the health and wellbeing of both dogs and their owners.

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## A RICHLY VARIED SPECIES

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Canines are one of the most exciting groups of mammals on our planet. They come and go on the evolutionary stage, both in terms of time and space. At the start of the twenty-first century, at a range of locations across the Northern Hemisphere, wolves were on the brink of extinction. Now, they are back in many countries across Europe and also in the United States. However, life is never the same—evolution cannot repeat itself. These modern wolves also hybridize with coyotes and free-ranging dogs, possibly giving way to new forms of canine. In Europe, hunters had not seen the golden jackal for a century, but now, within the last ten years, jackals have reconquered old territories and ventured into new ones. Some of them have been reported hunting in the north of Europe, close to the Baltic Sea.

The existence of dogs and their many varieties is one of the most extraordinary proofs for evolution. Charles Darwin himself referred to domestic animals and especially to dogs when citing animal examples of evolution. However, as change is part of evolution, we should not expect the variation we have in our dogs today to stay with us forever. New times and new challenges may prompt the evolution of new creatures, and dogs are no exception.

While mutual friendship between dogs and humans may exist in billions of households around the world, in many situations we still want to be in charge. Humans can be quite a nuisance in this respect. One such case is dog breeding. Reproduction is a key to the evolution of a species, and any major failure can have fatal consequences in the long run. Especially in the case of purebred dogs, which are close to the hearts of many people, present breeding practices need to

**Below** *Despite having been domesticated, dogs often remind us of their wild relatives.*



be rethought. Neither irresponsible neutering nor arranged mating with a few males or the “perfect” champion male is advantageous for any breed. It may lead to a fatally reduced breeding population, the increase of inbreeding, and the emergence of physical malformations, illnesses, and behavioral problems.

As so many of us now live in cities, dogs may be one of our few connections to nature, so we should make every effort to keep them as healthy as possible and offer them the best life while allowing them to express their full biological potential. Dogs should be kept as companions only if the owner has the time and devotion to allow them the freedom of being a dog in addition to being a member of a family or other social community of humans. In this sense, dogs should be seen as the “wolves of the cities”—independent whether they are big or small, like to bark, or roam free in our green spaces.

Let’s allow dogs to work if they enjoy it. People may or may not like to work, but dogs are different. They have been selected to like working with people, participating in joint activities. Research has also shown that many dogs are keen to work for people’s “love,” social feedback, and for the feeling that they are part of the family. As well as being genetic, as in the case of working breeds, this tendency can be facilitated through dog training. Thus, a well-trained dog, which has been chosen for this task, enjoys interacting with its owner. They would probably suffer if they were prevented from doing so. For dogs, working is closer to some kind of social engagement than a form of hard labor. In exchange, people express their feelings toward their dogs. But we should be careful not to demand too much; dogs also deserve to be dogs.





## ABOUT THIS BOOK

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**Below** *Dogs, especially those living in cities, need a lot of exercise to have a good quality of life.*



In this book, we hope to show you the dog from many different perspectives. Dogs are descendants of extinct wolflike canines, so they share many features with their wild cousins. Dogs also have a long and specific history with humans, and generations of dogs have witnessed how our societies have changed in the last 3,000–4,000 years. And, despite the fact that our relationship with dogs has become more intimate in some ways, dogs still remain dogs, in a good sense. So, we need to know about their biology: how they see, hear, and smell, and how they interact with one other and with humans, showing a wide array of sophisticated behavioral signals for communication. Dog owners have to become aware of the mental abilities of their companions in order to provide them with the necessary challenges to keep their minds sharp and active. This also ensures that dogs have a good quality of life during aging, as a more experienced and skillful dog has a lower chance of showing cognitive decline when it gets older.

Knowing about the development of dogs as puppies is crucial because this is the time when dog owners and breeders can have a huge influence on the future character of the dog. In sharp contrast to humans, who develop for around 18 years, in dogs maturation is much shorter, only one to two years. What a young dog may learn spontaneously after a few incidents may take much longer for an adult dog to acquire. Puppies learn as soon they are born, and if something is learned early, this can be remembered for their whole life.

And what about our future with dogs? In recent years, our societies have been changing at a rocketing speed. So far, dogs have been an exceptional means of providing us with a unique experience of friendship but now there are new competitors on the horizon. Television, the internet, and cell phones are giving many people, especially the young, the sense of being members of a community and there seems to be less time for developing human–canine relationships within the home. In the industrialized countries, the population of family dog numbers is stagnating or on the decrease—is this a sign of a relationship in decline?

Who can tell the future? But, for sure, humans have some responsibility for their creatures. The future of dogs lies in their behavioral flexibility, their ability to adapt to the newly emerging human needs in modern society. The new roles dogs play in our society give rise to new challenges for both dogs and dog trainers. We all have to make sure that dogs' needs are met, so they will continue to give us their company for centuries to come.

We hope that this book, which includes some of the newest insights from dog science, will help you, the reader, to respect your companion even more, or encourage you to find one of these wonderful partners to share your life with.

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CHAPTER 1

# *Evolution & Ecology*



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# Where Dogs Come From

There is a rather striking resemblance between the appearance of any extant member of family Canidae (the group of carnivores closely related to and including dogs) and the long-ago extinct *Miacis*, the common ancestor of terrestrial predators. Thus, the Canidae show ancient anatomical features, or rather they are similar to the ancient form. This does not mean that the shape and functions of dogs and their closest relatives are obsolete—the high number of species still existing testifies just the opposite: The ancient form is still successful.

## ORIGINS ON THE AMERICAN CONTINENT

The history of carnivorous mammals started about 55 million years ago (mya), not so long after the last of the great dinosaurs had disappeared at the end of the Cretaceous. Interestingly, *Miacis* emerged in North America—and the larger part of the evolution of Canidae also happened there. In the Paleocene (about 50 mya) the two main divisions of carnivores diverged, forming the catlike feliforms and the wolflike caniforms.

Toward the end of the Paleocene, about 34 mya, the *Caninae* subfamily appeared, and this would become the

**Right** *Canids can look considerably different. The maned wolf is the tallest of all (3 feet/0.9 m at the withers). The stocky bush dog is no bigger than a dachshund. Both live in South America.*



*Maned wolf*



*Bush dog*



*Miacis*

only surviving subfamily of the Canidae—and the ancestor of all the extant species of foxes, jackals, and wolves. The secret for their success may be that they were not overtly restricted to the hypercarnivorous (“meat only”) diet of other subfamilies, which became extinct because of their narrow ecological tolerance of environmental changes.

**Above** *The Miacis, a primitive carnivore, populated both Eurasia and the North American continent about 55–33 million years ago. Animals like this were the ancestors of extant canids, bears, and weasels.*

## “CANINE RADIATION” & THE COLONIZATION OF OTHER CONTINENTS

The evolution of early canids continued on the North American continent through the whole Oligocene until the second half of the Miocene. The so-called “Canine radiation” was an evolutionary “explosion” about 11 mya, when three major forms of canids—the wolflike *Canis*, the foxlike *Vulpes*, and the also foxlike *Urocyon* genera—appeared and became abundant in southwest North America (9–10 mya). Their success was hallmarked by the evolution of carnassials—a paired set of scissor-like molars and premolars in the upper and lower jaws, allowing the animal to perform an effective shearing bite—thus a better utilization of food.

These “modern” canids were those forms that left the North American cradle of terrestrial predators—first, about

**Below** *The first canids emerged in North America about 40 mya. Their descendants arrived in Eurasia only around 8 mya. Closer relatives of dogs (genus Canis) evolved in the Old World. Wolves “returned” to America less than 1 mya.*

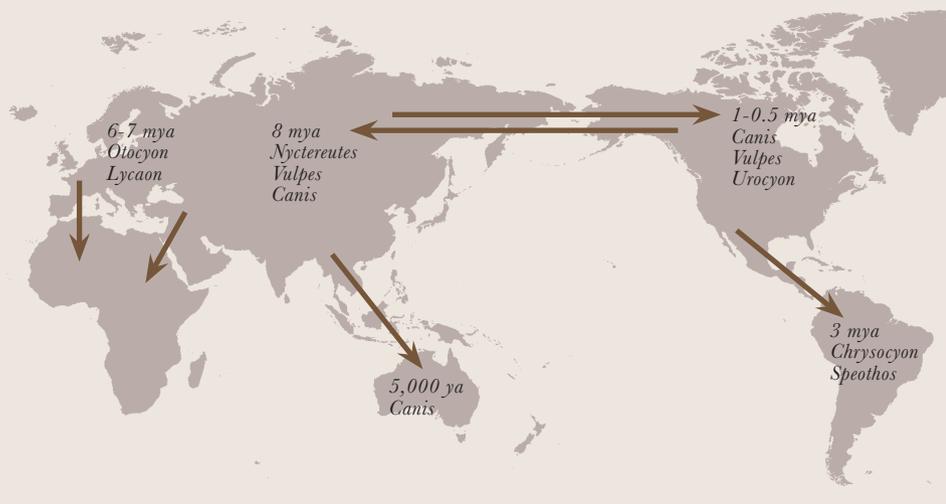
8 mya through the temporarily available Beringian land bridge (between Alaska and the Kamchatka peninsula) toward Eurasia and Africa. Most extant species of wolves, jackals, and foxes evolved in the Old World after this exodus. The second major radiation of Canidae took place at about 3 mya, when the Isthmus of Panama formed. This allowed some of the North American species to invade South America, where, besides the gray fox (*Urocyon cinereoargenteus*), endemic species evolved such as the bush dog (*Speothos venaticus*) and the maned wolf (*Chrysocyon brachyurus*).

## THE PLEISTOCENE & MODERN-DAY DISTRIBUTION OF CANIDS

Commonly known as the Ice Age, the Pleistocene is characterized by repeated cold (glacial) and warm (interglacial) periods, starting about 2.8 mya and

ending about 12,000 years ago. For Canidae, the notable events during the Pleistocene were the repeated waves of colonizing species (especially jackals) invading Africa from the north, and the arrival of Eurasian gray wolves back to their “ancestral land,” North America.

### EVOLUTION & RADIATION OF CANINES



## Why Caninae Survived

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With evolution comes not only the emergence of new species but also the extinction of many others. Extant canid species around in the world provide proof that this group of predators can be considered highly successful, especially because we know that many of their former distant or closer relatives have already disappeared from the Earth. Besides the larger impact of geological and climatic changes, the survival and extinction in the case of Caninae was mostly a question of their ecology.

### **BASIC ECOLOGY OF THE EXTANT CANIDS**

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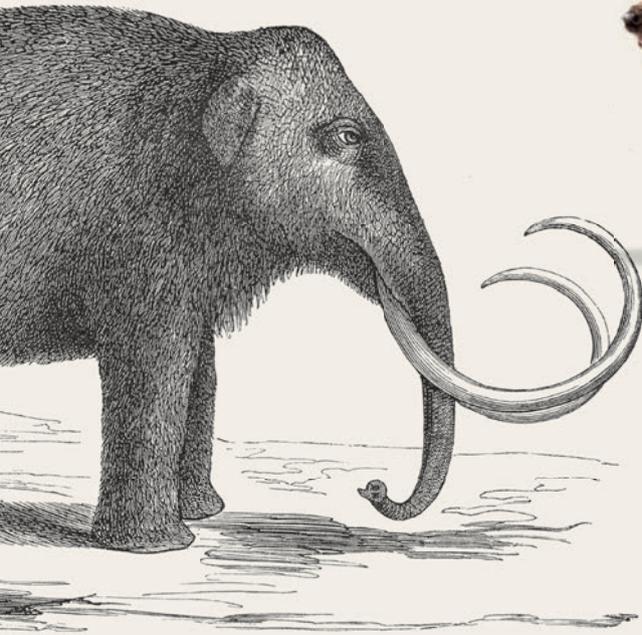
Depending on their body size, canids can consume prey as small as insects, or subdue large animals such as the elk and moose. However, almost all extant canid species are not typical hypercarnivorous species because they obtain only about 70 percent of their diet from animal protein sources; the rest comes from eating plants, fruits, or even nuts.

Canids are probably never solitary, maintaining at least a loose pair bond almost all year around—but more commonly they live in pairs, smaller families, and, in the case of some species, in larger packs. Extant canids can all be

considered as social species; the gray wolf, the dhole, and the African wild dog may also fit the term “hypersocial.”

Finally, canids can be regarded as very devoted parents, spending relatively long periods yearly on raising their offspring. Depending on their social habits, both adults and the previous year’s offspring participate in tending the young, which are born small, blind, and helpless and require a long period of parental care.





## THE SURVIVAL OF CANIDS AT THE END OF THE PLEISTOCENE

The end of the last glacial in the late Pleistocene came with a whole wave of extinctions, called the disappearance of the Ice Age megafauna. Many hundreds of large terrestrial mammalian species went extinct in a relatively short period of time, including successful survivors of several recurrent glacials and interglacials such as the woolly mammoth and the saber-toothed tiger. Canids were among those animals that fared much better than other taxa, with perhaps only one famous exception—the dire wolf (*Canis dirus*), which was one of the hallmark species that disappeared at the end of the Pleistocene.



## THE CASE OF THE DIRE WOLF

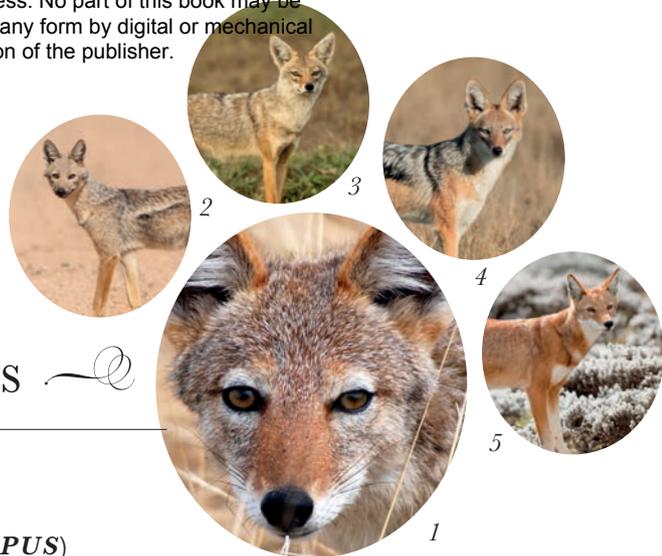
The dire wolf shows clearly the role of feeding ecology in the temporary success and later demise of a predator. Evolved on the American continent, dire wolves were the size of the largest of today's gray wolves—not especially big compared to their contemporary competitors such as the saber-toothed tiger, yet fully capable of hunting the largest prey species available in their time: bison, wild horse, and even mammoths. According to skeletal fossil records, dire wolves were highly social hunters that once populated both Americas. However, they started to show a population-wide decline about 20,000 years ago and went totally extinct during the next 10,000 years.

The main factor in their decline was their strong dependency on megaherbivore prey. Dire wolves were hypercarnivorous and could not flexibly switch to smaller prey when the largest herbivores became rarer. The gray wolf and the other extant canids survived because (besides their effective social behavior) they could react to the changing diet opportunities with greater flexibility.

**Above** Dire wolves evolved in North America and became extinct only toward the end of the last Ice Age. Being specialized to hunt the largest available prey, they eventually lost out to the more flexible gray wolves.

**Left** The mighty woolly mammoth was a widespread inhabitant of the Northern hemisphere during the Ice Age. Its relatively recent extinction (about 10,000 years ago) was most probably caused by swift climatic changes.

**Bottom left** The gray wolf is one of the most successful Canids. This large carnivore lives, reproduces, and hunts in packs. A pack can subdue even large-hoofed prey such as moose and elk.



# Distant Relatives of Dogs

The *Canis* family is represented by a few very closely related species that inhabit all continents except Antarctica (see table below). The close relationship is supported not only by their similar form and comparable life history, but also by their genetic makeup, which is so similar that individuals from different species can breed with one other. Interbreeding may also happen in nature, providing the possibility of further evolution in this group of predators. This also means that the English names such as “wolf,” “jackal,” and “coyote” are based more on tradition rather than reflecting a biological category.

## WOLVES (*CANIS LUPUS*)

After the major extinction wave at the end of the Pleistocene the wolf survived as the top predator in North American and Eurasia. While the gray wolf remained the most abundant species, it has evolved into many divergent subspecies that differ in size, food choice, and lifestyle. Most recently, the Ethiopian wolf (formerly Ethiopian jackal) was assigned to this group because researchers discovered it is genetically more closely related to wolves than jackals, despite living in Africa.

**Above** The black-backed jackal (1 and 4), side-striped jackal (2), golden jackal (3), and Ethiopian wolf (5, formerly Ethiopian jackal, now regarded as a wolf species). Jackals live in various locations in Europe, Asia, and Africa.

### COMPARATIVE SUMMARY OF *CANIS* SPECIES (BASED ON SHELDON 1988)

Species	Shoulder height	Weight	Diet
Side-striped jackal ( <i>Canis adustus</i> )	16–20 in./41–50 cm	14–31 lb./6.5–14 kg	Omnivorous; carrion, small animals, plants/fruits
Golden jackal ( <i>Canis aureus</i> )	15–20 in./38–50 cm	15–33 lb./7–15 kg	Carrion, small animals; coop. hunting
Black-backed jackal ( <i>Canis mesomelas</i> )	15–19 in./38–48 cm	13–30 lb./6–13.5 kg	Carrion, plants/fruits; coop. hunting
Ethiopian wolf ( <i>Canis simensis</i> )	21–24 in./53–62 cm	24–42 lb./11–19 kg	Rodents; hunts alone
Gray wolf ( <i>Canis lupus</i> )	18–32 in./45–80 cm	40–132 lb./18–60 kg	Carnivorous; carrion, plants/fruits; coop. hunting
Coyote ( <i>Canis latrans</i> )	18–21 in./45–53 cm	15–44 lb./7–20 kg	Carnivorous; carrion, plants/fruits; coop. hunting
Red wolf ( <i>Canis rufus</i> )	26–31 in./66–79 cm	35–90 lb./16–41 kg	Small animals, carrion, plants

## COYOTES (*CANIS LATRANS*)

This species evolved in North America (and is an endemic species there). Coyotes have a very similar lifestyle to wolves, although they are somewhat smaller and do not establish large groups. Until recent times coyotes have occupied only the more southerly areas of North America; but recently the populations have started to migrate northward.

## JACKALS

This group within *Canis* is subdivided into three species. Jackals are generally much smaller than wolves and coyotes, and tend to live in small family groups. The golden jackal (*Canis aureus*) is commonly distributed in Southern Europe and Southern Asia, but recently this species started to migrate to the north of the European continent—for example, jackals were sighted in Estonia in 2013. The black-backed jackal (*Canis mesomelas*) and the side-striped jackal (*Canis adustus*)

inhabit Africa from the Sahara south. They prefer to live in open areas and move around in pairs or small families.

## RED WOLF & OTHER FORMS

Researchers disagree about the phylogenetic status of some wild canine populations. For example, the majority consider the red wolf as a separate species (*Canis rufus*), but it could represent a hybrid between wolves and coyotes. More recent findings also indicate that wolves and coyotes, and even free-roaming dogs, may hybridize more frequently than thought previously. This may lead to specific populations of canines being more successful in surviving because they are better able to tolerate ecological changes, including increasing temperatures and the continuous and broadening threat of human disturbance.

**Below** Species of the *Canis* genus are closely related and this is indicated by similarities in form and behavior. The gray wolf (6 and 7) has less than a handful of relatives: the red wolf (8) and coyote (9).



### Gestation, litter size & care

### Social organization

### Home range

57–70 days (max. 7 offspring)	Pair + offspring	ca. 0.4 mi. <sup>2</sup> /1.1 km <sup>2</sup>
63 days (max. 9 offspring); biparental, alloparental	Very variable, pair + offspring (+ yearlings)	Hunting range 1–7.7 mi. <sup>2</sup> /2.5–20 km <sup>2</sup>
61 days (max. 9 offspring); biparental, alloparental	Pair + offspring	ca. 7 mi. <sup>2</sup> /18 km <sup>2</sup>
60–2 days (max. 6 offspring); biparental, alloparental	Pair + offspring	ca. 1.5–2.3 mi. <sup>2</sup> /4–6 km <sup>2</sup>
62–5 days (max. 13 offspring); biparental, alloparental	Very variable, pair + offspring + yearlings	ca. 7–5,000 mi. <sup>2</sup> /18–13,000 km <sup>2</sup>
ca. 60 days (max. 12 offspring); biparental, alloparental	Very variable, pair + offspring + yearlings	ca. 7–39 mi. <sup>2</sup> /1–100 km <sup>2</sup>
60–2 days (max. 8 offspring); biparental	Very variable, pair + offspring + yearlings	ca. 15–31 mi. <sup>2</sup> /40–80 km <sup>2</sup>

# Emergence of Wolves

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## THE IMPORTANCE OF GRAY WOLVES

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Gray wolves (*Canis lupus*) are probably the best-known, most iconic wild canid species. Besides being the closest living relative to the dog, the gray wolf is the most successful large terrestrial predator of recent times. As apex carnivores, with the exception of humans, wolves probably had the greatest biological impact on the late evolution of the ecosystem of the Northern Hemisphere.

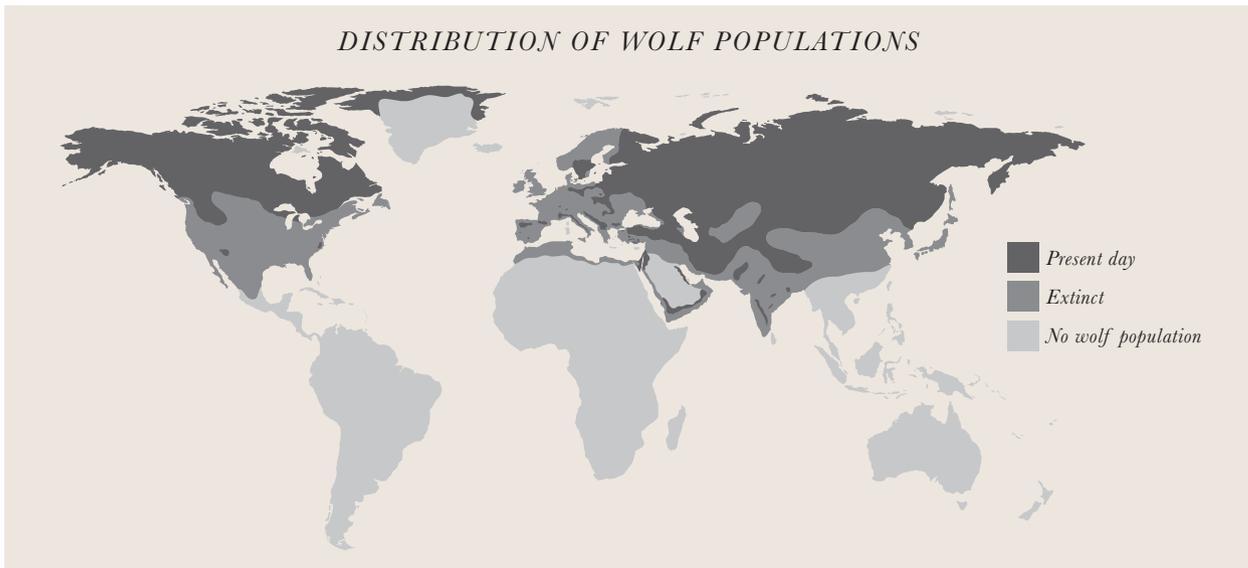
## MAIN STEPS OF EVOLUTION IN A NUTSHELL

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The gray wolf is a relatively young species, although wolflike members of the genus *Canis* were abundant in the late Pliocene and most of the Pleistocene epoch (3–1 mya). It evolved in Eurasia, in several genetically distinct clades. Besides inhabiting the whole of the enormous Old World (except Africa), gray wolves appeared for the first time in North America relatively recently, less than 300,000 years ago.

**Below** Although gray wolves can be found all around the Northern hemisphere, compared to their vast home range a few thousand years ago, their recent distribution shows a strong decline due to their conflicts with humans.

*DISTRIBUTION OF WOLF POPULATIONS*



Paleontology and molecular genetics confirmed that from today's existing members of the family *Canis* the earliest diverged line led to the golden jackal. Somewhat surprisingly, the coyote is almost uniformly considered as the closest living relative to the gray wolf because other, more closely related species died out in Eurasia.

## WOLVES IN THE ICE AGE

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At the peak of the Ice Age (15–25 thousand years ago), permanent ice covered most of the North American continent to the south of the Great Lakes, large areas of Eurasia (mostly modern-day Russia), the whole of Scandinavia and the British Isles, and Europe down to the northern Carpathians. The “cradle” of the species was assumed to be in the eastern part of Eurasia. Beringia (an area of land joining Alaska and the easternmost end of Eurasia) remained ice-free and the Bering Strait offered a possible route for early wolves and their relatives to move back and forth between the “old” and “new” worlds. The last and most successful wolf-invasion occurred only 80,000 years ago. As the last ice age was probably the fiercest of them all, further incursions of Eurasian wolves became impossible due to the melting of ice fields across the whole continent.

## THE APEX PREDATOR OF THE NORTH

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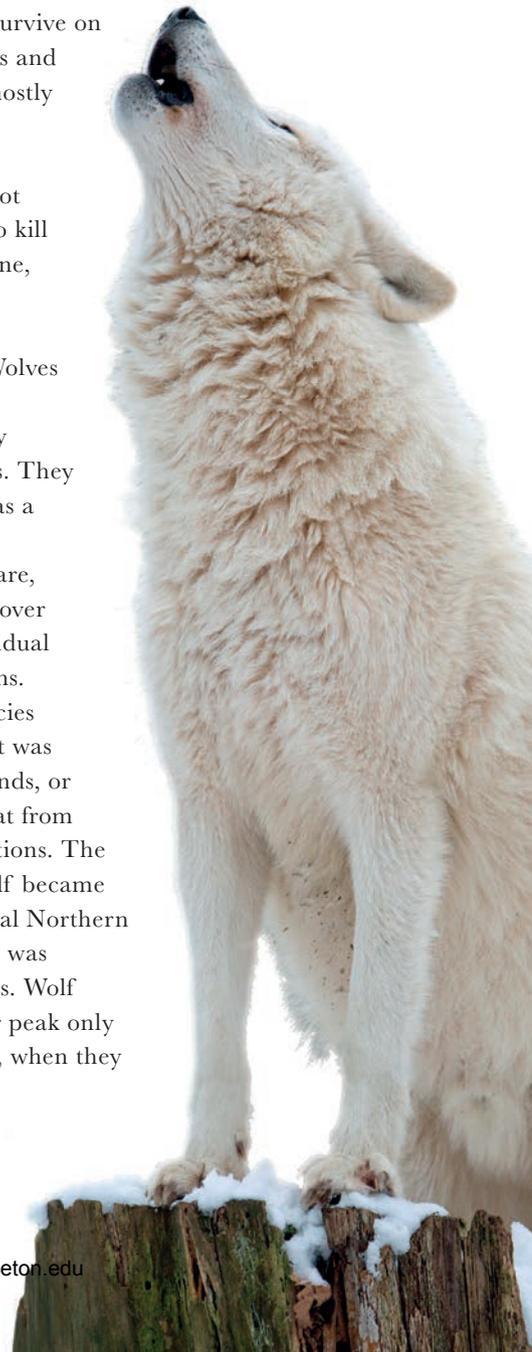
Although the gray wolf is the largest of all extant Canidae (large males of the holarctic type can reach 176 lb./80 kg in weight and 32–34 in./80–85 cm in height), its dimensions are still smallish

compared to some of the bears, and especially to the great cats (such as the *Smilodon*) that went extinct just toward the end of the last glacial period.

The secret of the unique evolutionary success of wolves is their ability to eat various prey types and to form highly effective social groups. In times of need, wolves are able to survive on small prey (such as rabbits and rodents), although they mostly hunt the largest available prey—hoofed animals. Importantly, wolves are not large enough to be able to kill an adult moose or elk alone, but here is where the formation of large packs becomes an advantage. Wolves cooperate to kill a larger animal and share the prey among the pack members. They also raise their offspring as a communal effort.

Wolves were, and still are, very mobile and able to cover large areas, both as individual animals and as populations. This feature gave the species further advantage when it was possible to exploit new lands, or when it was time to retreat from worsening climatic conditions. The highly successful gray wolf became abundant in the postglacial Northern Hemisphere, where game was plentiful in the vast forests. Wolf populations reached their peak only a few thousand years ago, when they met their fate—humans.

**Below** *Wolves are highly social. They use various vocalizations, of which howling is undeniably the most well-known. Howls are used to synchronize pack activities and also to herald the presence of wolves to neighboring packs.*



## HUMAN & WOLF— WOLVES OF THE PRESENT

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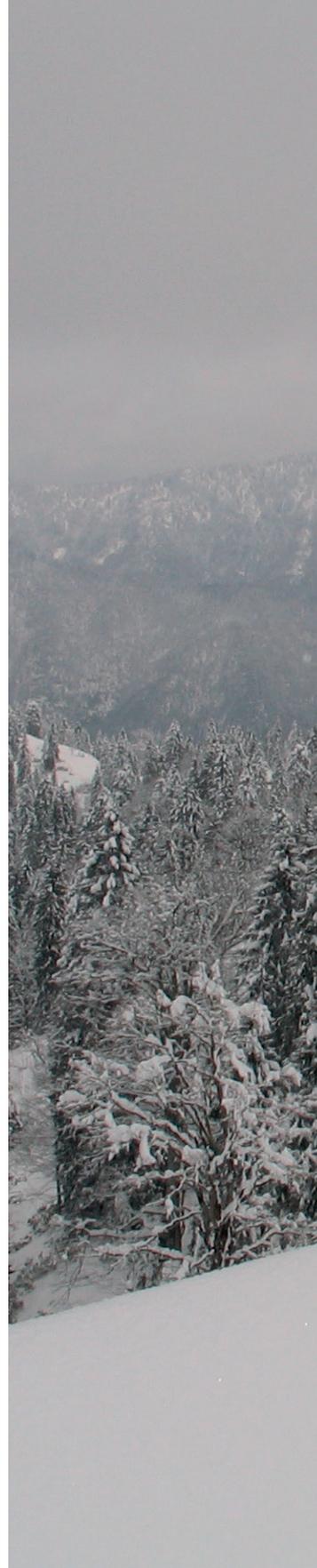
Modern humans (*Homo sapiens*) are even younger as a species than wolves. These human populations settled in Europe and Asia 40,000–60,000 years ago, when they first met various representatives of the extended wolf population. There is little evidence of hostility between man and wolf up until the last 10,000 years. Both species were highly skilled group hunters of larger and smaller prey, and did not regard each other as suitable prey. Although at some Paleolithic excavation sites the bones of wolves killed by humans were discovered, their amount did not exceed the level of incidental hunting. Hunter-gatherer human groups might eventually have become wolves' rivals, but there was not yet open warfare.

The situation changed when humans turned toward agriculture and livestock keeping. Wolves became the hated and feared predators of those animals that provided a living for our ancestors—therefore they had to be eradicated. Eventually, the “big bad wolf” became the embodiment of “evil”—and medieval people successfully exterminated most of the European wolf population. Another anthropogenic factor in wolf recession was the alteration of the landscape: Due to large-scale deforestation, wolves lost both their habitat and prey species. In Europe alone, at the beginning of the twentieth century, the proportion of forested land had declined to 20 percent from an estimated 75 percent at the turn of the tenth century.

Today the world's total wolf population is estimated at around 300,000 specimens. Gray wolves were almost entirely extirpated from their former habitats of southern North America, northern and western Europe, India, and Japan. Apart from isolated populations across these areas, the majority of gray wolves today live in the coldest and most forested regions of North America and Eurasia.

During the twentieth century wolves became an endangered species in many countries, and efforts were made for the reintroduction of wolves to particular sites. The best-known reintroduction took place in the Yellowstone National Park in the United States in the 1990s, with large-scale ecological consequences that mainly resulted in a decrease in the elk and deer populations and the recovery of forested areas due to the lighter grazing pressure. The wolf is now also expanding in Europe, with new populations established in Switzerland and Germany.

The preservation (and reintroduction) of wolves remains a sensitive issue everywhere and needs to be carefully considered before implementation. Wolves do not discriminate in their prey between game and livestock, so the coexistence of humans and wolves as two “top” predators is far from being settled. Intensive debates have arisen in countries, including in the United States, where, after many years of having been protected, the expanding wolf populations have made some policymakers argue for the reintroduction of wolf hunting.



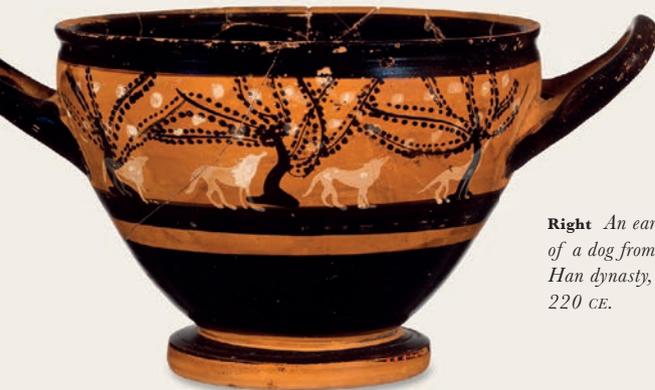
**Below** *Today wolves can live mostly undisturbed only in the High North. This adaptable carnivore still lives in large numbers where winters are long, large prey is abundant, and humans are rare.*



## First Links with Humans

Domestication is an evolutionary process during which some ancient wolf populations became adapted to humans and to the anthropogenic environment through a series of genetic changes. The exact details of this process, however, have remained obscure, and this has kept many scientists busy in recent decades working on new theories and ideas. All agree on one point: The history of dogs and humans in the last 16,000 to 32,000 years has been tightly interwoven.

**Below** Dogs feature on Ancient Greek black-figure work, such as this terracotta skyphos (drinking cup) from around 500 BCE.



**Right** An earthenware figure of a dog from the Eastern Han dynasty, China, 25 to 220 CE.



**Left** A limestone statue from Cyprus from around the 4th to 3rd century BCE.



**Above** This Egyptian mummy contains dog bones and is believed to date from between 400 BCE and 100 CE.

## THEORIES OF DOMESTICATION

There are many theories of domestication, most of which have some credible elements. Considering all of them together probably gives the most plausible account of the sequence of events. Here are some examples:

### **1. Socializing wolf cubs (individual-based selection):**

Pups of wild canids show very diverse behavior toward humans, so it is possible that wolf cubs raised by humans and showing the “right” temperament were selected for over many generations.

**2. Wolves domesticated themselves (population-based selection):** Humans’ activities (such as hunting) produced an excess of garbage, a novel, easy-to-exploit food source. This could have been utilized by (some) canine populations over generations. Smaller individuals, which could live on such food and were not frightened by the presence of humans, become gradually isolated from the rest of the wild population (just like city pigeons).

*Below According to archaeological records, ancient Arctic dwellers may have been among the first humans to breed dogs for pulling sleds.*

**3. Preference for wolves (human group selection):** Human groups with an affiliative tendency toward canines had selective advantage, because observing their behavior might have helped in hunting and in establishing settlements. As a result, both humans attracted to dogs and dogs themselves become widespread.

**4. Diversification of dog roles:** Originally dogs had only restricted roles, but later humans found ways to employ them in different tasks (such as hunting partner, heater, guard, sled-puller, and food source).



## HUMAN MEETS WOLF



### 300,000–400,000 years ago

Three species of the *Homo* genus, who had left Africa earlier, probably encountered wolves along their journey. However, no change in wolf populations took place during this time.

### 45,000–120,000 years ago

Modern humans, *Homo sapiens*, left Africa and colonized Europe and East Asia in several waves. Recent dogs may have emerged as a consequence of encounters between modern humans and wolflike canines. Remains of an Upper Paleolithic doglike animal were discovered in Belgium, and found to be about 31,000 years old.

### 10,000–12,000 years ago

Remains suggest that dogs' size reduced by 38–46 percent, and they participated in hunting. In an Israeli burial site the hand of a deceased human was positioned over the body of a puppy, suggesting an affectionate relationship. People practiced ritual burials of dogs in all parts of the world; other domesticated species were buried much less frequently.

### 8,000–10,000 years ago

The presence of dogs is confirmed by wall drawings depicting hunting scenes in Turkey. Small-bodied dogs have been recovered in Germany, Sweden, Denmark, Estonia, and England. In a Serbian site on the bank of the Danube, a high number of broken dog bones and skulls suggest that fishing and hunting communities ate these animals. The first archaeological evidence that dogs reached North America dates to 9,000 before the present.

### 4,000–6,000 years ago

Many drawings and sculptures depicted dogs. In parallel with rapid technical changes, humans started to select dogs for various working roles, which resulted in characteristic sets of morphological and probably behavioral traits. On Egyptian pottery and rock art most dogs look like sight hounds with slender bodies, erect ears, and curly tails.

### 3,000–4,000 years ago

Animal figures and rock carvings suggest that dogs were used in herding and also in guarding. Individuals varied in size and had a curled tail and floppy ears. The first dogs arrived in Australia and the free-ranging populations evolved to dingoes. Dingoes still have a prominent role in the culture of Aboriginal Australians, and they are depicted on rock carvings and cave paintings.



### 20,000 years ago

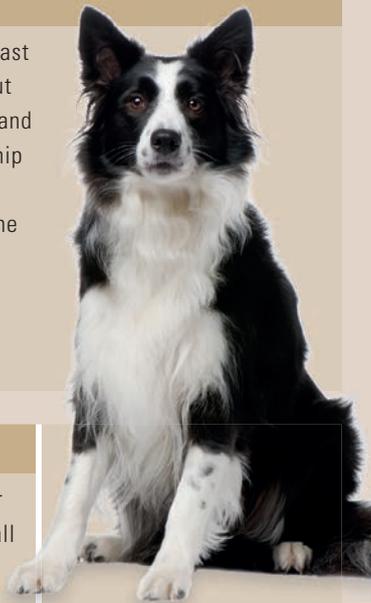
(after the last glacial) Human populations expanded and by 10,000–15,000 years ago most continents had human occupants. During this phase agriculture emerged in several places.

### 12,000–15,000 years ago

Humans established large permanent settlements, which provided a barrier between wild and anthropogenic canine populations. Clear evidence for human/canine cohabitation comes from Germany in the form of 13,000-year-old bones. Trading humans and dispersal events could have rapidly widened the distribution of doglike animals.

### 6,000–8,000 years ago

Dogs were introduced from the Near East to Egypt and later dispersed throughout Northern Africa. Joint burials of dogs and humans suggest an intimate relationship between Native American hunters and dogs. The most widespread dog was the Mesoamerican common dog (withers height 16 in./40 cm).

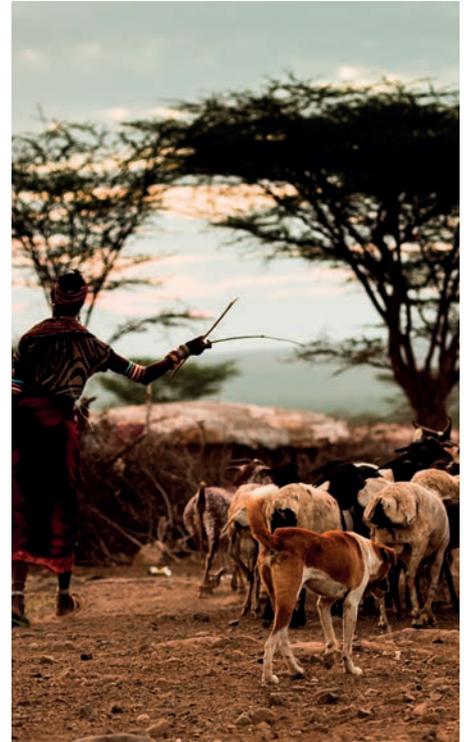


### 1,500–3,000 years ago

During the Roman period, selection for increased size is evident, but very small lapdogs also became more common. This suggests the appearance of targeted selective breeding for looks rather than for their value at work. During this time dogs reached the most southerly parts of Africa with the migrating Bantu peoples.

### 150–200 years ago

Most dog breeds were developed.



## PRESENT-DAY TRADITIONAL SOCIETIES & THEIR DOGS

The Turkana people of Kenya have the highest prevalence of tapeworm infection in the world, probably due to the unique role dogs play in their life as nomadic pastoralists. Dogs are not only the playmates of children, but they also clean up after the child if it defecates or vomits. Dogs also lick cooking-ware and serving-ware clean, and consume the menses of the women. Given that the fresh water supply is limited in this semiarid region of northwest Kenya, this practice is understandable.