Man-Made Dogs

The origins of the domestic dog, South American canids, and the enigma of the Falkland Island wolf are discussed.

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Summary: The origins of the domestic dog are discussed in relation to the hunting and nurturing behavioral patterns of man and the social canids. While it is accepted that the wolf was the progenitor of the dog the possibility that other species of canid were tamed and interbred with early domestic dogs is not disputed. A description is given of the recently extinct *Dusicyon australis* and it is suggested that this South American canid may have been tamed and then introduced and domesticated by man in the Falkland Islands during the early Holocene.

Behavioral Aspects of Domestication

Remains of domestic dog have now been recorded from many archeological sites of the early Holocene epoch. Besides the first finds that aroused some controversy, such as those from Star Carr, England (*1*), and Mount Carmel, Israel (*2*), there are now more recent records from Idaho, North America, as well as others from Europe, western Asia, and Japan (*3*). All these finds date from around 10,000 years ago and indicate that wherever man traveled in the early post-Pleistocene he was likely to take "dogs" with him, or rather, tamed canids as they should be called at this early stage. The domestic dog could only become differentiated as a separate breeding population after tamed animals had been bred for some generations in isolation from the wild parent species.

I believe that the highly developed social behavioral patterns of man evolved as a response to the needs of the hunter of large prey, as they did with the wolf, the progenitor of the dog. If a predator is to succeed it must either kill animals that are smaller than itself or, if the prey is large, a team effort must be employed, and this necessitates social structure. The primitive social behavioral patterns of man, described by Washburn and Lancaster (*4*), went far beyond those of any other social predator in that they evolved into a coordinated system leading to division of labor and the ability to share, not only food, but responsibility for the welfare of the community. It is this capability of man for sharing that provides the key to the origins of the domestic dog, which I believe began with pet keeping, although this did not preclude eating the animals when necessary or convenient.

It is probable that the human hunting communities of the late Pleistocene would have given succor to any animal that would stay near them, as they would to their children, and as primitive peoples will do to this day. Young canids would be tamed along with many other animals, the species depending on the locality. In North America the canids would be the wolf and the coyote, in South America the indigenous "foxes," in Europe the wolf (and jackal in the East), in Asia the wolf and jackal, and in Africa the jackals and perhaps the hunting dog. But these loose associations between man and animal were ephemeral. To comprehend the essence of domestication it is necessary to understand the reasons why the bonds between man and certain species of animal became permanent. Relatively few such associations have, in fact, endured and this must be because, except for a few anomalies such as the domestic cat, only the most highly social mammals will survive total dominance by man. The wolf, like man, lives in a family group based on dominance hierarchies, so that imprinting on man as the group leader can be extended into adult life. Other more solitary canids which are predators of smaller prey do not have this elaborate social structure, with the result that the imprinting is insecure in adult life and the canids are unlikely to breed well in captivity. It is because the social structure and hunting behavior of the wolf and man are so similar that their association is so closely bonded.

All the studies that have been conducted on the behavior of canids support the hypothesis that the wolf was the ancestor of the dog (*5*). Furthermore, examinations of the morphological characters of the dog, including brain shape, skeletal anatomy, and dentition, all point to closer resemblances to the wolf than to other species of *Canis*, these being the coyote, *Canis latrans*, and the jackals *C. aureus*, *C. mesomelas*, *C. adustus*, and *C. simensis*. The review of canid taxonomy recently undertaken at the British Museum (Natural History) (*6*) suggests that, while the dog and Australian dingo lie closest to the wolf in phenetic characters, the jackal, *C. aureus* (the only species of jackal to overlap the wolf in distribution) is not far separated from them.

All the species of *Canis* that have been examined have the same chromosome number of 78, and interspecific crosses with fertile offspring have been proved for the domestic dog with *C. lupus*, *C. aureus*, and *C. latrans* (*7*). It would seem, therefore, that the likelihood of introgressive hybridization occurring between domesticated canids should not be ruled out. This could have occurred between "dogs" that had been primarily domesticated from separate species or by the crossing of domestic animals with wild stock, for example "wolf-dogs" with wild coyotes or jackals. This might help explain the phenomenally high variation produced by selective breeding in modern dogs.

Domesticated Canids in South America

Hamilton Smith wrote in some detail on the contemporary domestication of the South American indigenous canids which he called Aguara dogs and placed in a new genus, *Dusicyon* Hamilton Smith, 1839 (*8*, pp. 246–247). Depending on the taxonomy that is followed, there are up to 11 species now included within the genus *Dusicyon*, and all are restricted to the continent of South America and its neighboring southern islands. The phenetic characters of the genus fall between those of the species of *Canis* and the true foxes belonging to the genus

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Vulpes. This intermediate state has led to their description as "foxes," "wild dogs," "wolves," and even "fox-tailed wolves."

Although some of Hamilton Smith's reports might now be open to more than one interpretation there is no reason to doubt the general truth of his first-hand accounts of the Aguara dogs, of which the following is an excerpt:

> Several [members of the genus *Dusicyon*] can be sufficiently tamed to accompany their masters to hunt in the forest, without however being able to undergo much fatigue; for, when they find the sport not to their liking, they return home to await the return of the sportsmen. In domesticity they are excessive thieves, and go to prowl in the forest. . . . All subsist upon the usual food of wild canines, but with the addition that they eat also fish, crabs, limpets, lizards, toads, serpents, and insects. They are in general silent and often dumb animals; the cry of some is seldom and but faintly heard in the night, and in domestication others learn a kind of barking.

A footnote after further description of these canids states:

> We find from late information that within the last thirty five years the indigenous dogs of the Indians have been gradually replaced by domestic European, and that now it is difficult to find any even in the more remote parts of the interior. When we were in the country, this was not the case.

If these statements are anywhere near the truth they may help to elucidate the problem of the origin and peculiar features of *Dusicyon australis*, the Falkland Island wolf (Fig. 1). This canid (which was not a wolf although it bore a closer resemblance to one than any other member of the genus *Dusicyon*) died out in about 1880 having been exterminated by sailors, fur trappers, and settlers on East and West Falkland Island, as described by Darwin (*9*) and other early writers. Hamilton Smith (*8*, p. 252) records having seen great numbers of pelts in a New York fur store, but now only 11 skulls and a few skins remain of this species (*10*).

Dusicyon australis is somewhat of an enigma for the following reasons. The pelage is distinctive from that of any of the mainland species of *Dusicyon*, being more rufous and having a white tail tip, white on the muzzle, and white on the lower limbs. The skull is large and rather wide in the palate for its length. The dentition has some unique features but the teeth are closer in their morphology to those of *Dusicyon* than they are to other canids. The skull has no interparietal crest as is common in *Canis* but the frontal bones are expanded, giving the forehead the bulbous look that is so common in domestic dogs. In the mainland *Dusicyon* species the frontal bones are quite flat and rather fox-like, but without the little hollows in the postorbital processes that are diagnostic of *Vulpes*. Taking all features together it seems that the Falkland Island wolf was either a relic of a domesticated form of *Dusicyon* or a feral hybrid evolved from a cross between a domestic *Canis* species and a *Dusicyon* species. Unfortunately there is, as far as I know, no experimental evidence for the intergeneric crossing of *Canis* with *Dusicyon* (which has a probable chromosome number of 74), but the possibility of its occurrence, particularly under conditions of captivity, should not be ruled out.

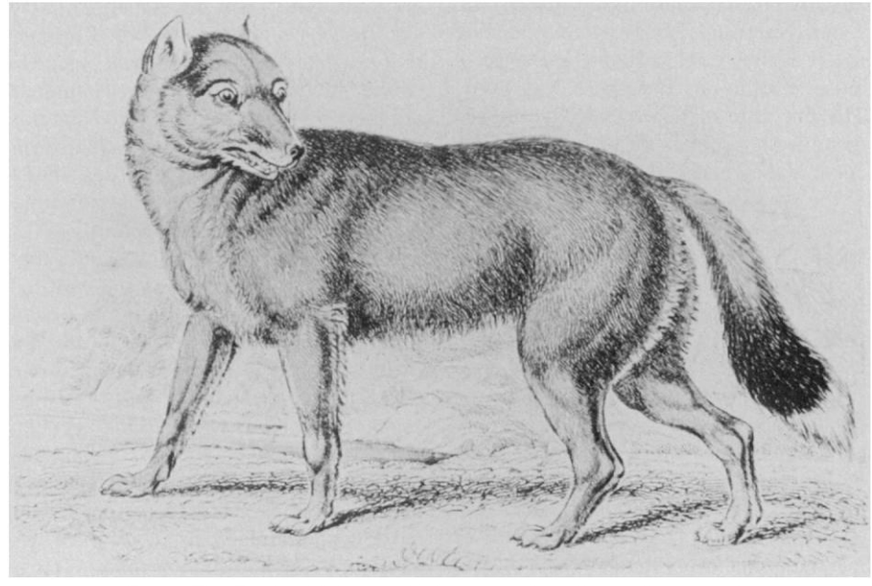

Fig. 1. The Falkland Island wolf, from Hamilton Smith (*8*, plate 23).

Darwin reported that *D. australis* was the only indigenous mammal to be found on the Falkland Islands and that it fed mainly on birds (*9*). The shortest distance between the mainland and the Falkland Islands is too great (approximately 480 kilometers) to imagine the successful dispersal of this animal to the islands unless taken there by man. Nor is it likely that a single mammalian species, and a large carnivore at that, survived on the islands throughout the Pleistocene when periods of periglacial conditions prevailed.

In some respects the Falkland Island wolf can be compared with the Australian dingo (*Canis dingo*). Both show the same characters that are associated with domestication, these being white markings on the pelage, a wide muzzle with large somewhat compacted teeth in the premolar region, and expanded frontal sinuses. The dingo is now generally accepted as being a feral domestic dog, perhaps of many thousands of years standing; it is probably also the last "pure breed" of dog in the world, but will not remain so unless protected. There is, in fact, no reason why man could not have taken tamed or domesticated canids either to the Falkland Islands or to Australia at any time during the prehistory of the last 10,000 years.

Ectoparasites of Dog and Dingo

Further light might be thrown on the movements of prehistoric men and their dogs by a study of the lice that parasitize present day canids. These ectoparasites tend to be host-specific, that is, each species of louse is found on animals within a single genus or sometimes only on a single host species. Amongst the various genera of both biting and sucking lice that are found on domestic dogs, the case of *Heterodoxus spiniger* (a biting louse) is particularly interesting. Hopkins (*11*) pointed out that the species of louse within the genus *Heterodoxus* are all found on Australian marsupials, with one exception, this being *H. spiniger* which is found on domestic dogs, coyotes, and jackals. Hopkins suggested that this species of louse evolved after transference to the dingo from a marsupial, perhaps shortly after dogs were introduced by prehistoric man to Australia, and that it spread to the continent of Asia on returning dogs. At the present day *H. spiniger* is widespread on canids in many parts of Africa, Asia, Australia, and America, but not apparently in Europe or the northern regions of North America.

The skins of the Falkland Island wolf

(*D. australis*) that are in the British Museum (Natural History) were examined to see if they could provide evidence of louse infestation, but there was none. The presence of lice could have helped to solve the problem of the origins of this canid if they had been identifiable either to the species commonly found on *Dusicyon* species or to those found on *Canis* species.

Discussion

Domestication may be defined as the exploitation of one group of social animals by another more dominant group which maintains complete mastery over its breeding, organization of territory, and food supply. Only certain groups of mammals can flourish under such drastic alterations to their way of life. On the other hand, all mammals can be tamed if reared close to man from an early age, and I believe that individuals from most species that lived in the same environment as early man were tamed, at one time or another, and were kept in captivity for short periods. Domestication will only follow, however, if the social behavioral patterns of the tamed animals are sufficiently well developed to allow successive generations to breed in captivity, isolated from the wild species. Obviously the most highly social animals are the most easily domesticated and this is why the South American Indians preferred the European dog (descended from the wolf, *Canis lupus*) to their more recalcitrant but tamed dusicyons.

Although Lorenz's original view, that domestication of the jackal and wolf led to two separate strains of dog, has been disputed and is no longer believed even by its author, it was Lorenz who was one of the first to draw attention to the now seemingly obvious connections between the social behavior patterns of animals and man. Twenty years ago discussions on these topics were in disrepute and those who indulged in them were accused of being anthropomorphic. Now it is quite the other way about, so that in discussions on animal behavior it is permissible to include early man as a primate with highly developed hunting behavioral patterns and the ability to coerce other animals to live with him. Like Lorenz in his foreward to *The Wild Canids* (*12*) I used to believe, having also read Jack London's *White Fang*, that, "a tame purebred timber wolf would be the highest ideal of a dog to which man could aspire," but I must agree that this is, indeed, an error. We cannot go backward and in terms of social evolution it is the "humanized dog" that is the pinnacle of domestication. The Pekinese lap dog epitomizes this association no less than the huntsman's tireless hound.

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NEWS AND COMMENT

Recombinant DNA: NIH Rules Broken in Insulin Gene Project

A breach of National Institutes of Health rules on gene splicing occurred earlier this year in the Department of Biochemistry and Biophysics at the University of California, San Francisco, one of the leading centers for practice of the new technique. No hazard resulted, but the episode underlines some of the difficulties experienced by research laboratories in adapting to the new rules.

The breach was the use of a biological component, or "vector," before it had been certified by the NIH director. The researchers, a team engaged in isolating the rat gene which codes for insulin, say they destroyed the experiment as soon as they realized their mistake.

The experiment was repeated in a certified vector and published in *Science* on 17 June. It received considerable attention because the researchers had achieved, much earlier than expected, the first step toward the goal of isolating the human insulin gene and using it for the manufacture of insulin protein. The UCSF team was in competition with a group at Harvard which was known to be working with a better source material.

UCSF's preeminence in the gene-splicer's art has brought it some mixed blessings. Because of the practical implications of what its researchers are doing, a company called Genentech has established a relationship with Herbert Boyer, one of the pioneers of the technique. Members of the insulin team have set up a nonprofit corporation, the California Institute for Genetic Research. These commercial developments are a tribute to the department's success, but have also created internal stresses. "Capitalism sticking its nose into the lab has tainted interpersonal relations—there are a number of people who feel rather strongly that there should be no commercialization of human insulin," says UCSF microbiologist David Martin.

Another mixed blessing is fame, which has attracted press attention not only to the department's achievements but also to certain internal tensions. A lengthy and circumstantial article in the June issue of the *Smithsonian* called into question the respect accorded to the NIH safety rules by UCSF researchers, and in particular by the younger, postdoctoral workers who perform most of the experiments. Written after a 3-month internship in Boyer's lab by Janet L. Hopson, formerly a reporter for *Science News*, the article observed that "half of the researchers here follow the guidelines fastidiously; others seem to care little. . . . Among the young graduate students and postdoctorates it seemed almost chic not to know the NIH rules," Hopson noted. In a letter to the editor criticizing the article, Boyer stated that "In practice [the NIH rules] are followed seriously."

The stresses of both commercial success and media attention came together this May when the insulin team announced their production of the rat gene.