Stalking the Ancient Dog

Man's best friend may go way back

Early dogs may have resembled these Carolina dogs, with their ginger-colored coats and foxlike faces.

I.L. Brisbin

By CHRISTINE MLOT

As ecologist at the Savannah River Site near Aiken, S.C., I. Lehr Brisbin Jr. keeps close tabs on the wildlife in the 300-square-mile spread surrounding the Department of Energy's nuclear facility. Beginning in the 1970s, in the course of routine monitoring of animals for radioactive contaminants, he occasionally came across wild dogs roaming the pine savannas or nosing around the dumpsters.

The dogs all seemed to be of a certain type: slightly shy with a medium build, foxlike face, large upright ears, and crook tail. With their tawny coats, the dogs could have stood in for Old Yeller, the quintessential canine of the rural South.

Brisbin, a zoologist at the University of Georgia and a long-time dog owner, gradually came to the conclusion that the wild dogs are physically and behaviorally distinct enough to constitute a uniform breed. The Carolina dog is now recognized by the United Kennel Club.

He also thinks there is something even more unusual about the dogs. They bear a strong resemblance to the dingo, the wild and ancient dog of Australian aborigines. Dingos and certain other Asian canines share with the Carolina dog the ginger-colored coat, which Brisbin says is a hallmark of a very ancient lineage. They also share an enthusiasm for scavenging.

The Carolina dogs, Brisbin suspects, may be North America's most primitive dog, representative of—if not closely related to—the domesticated canines that accompanied nomads across the Bering Strait into North America 8,000 years ago.

Brisbin, who writes about primitive dogs and the importance of understanding the dog's origins (see sidebar) in the April 15 JOURNAL OF THE AMERICAN VETERINARY MEDICAL ASSOCIATION, cautions that his interpretation is a hypothesis. The Carolina dogs could simply be a more recently isolated population of European descent or other canine stock. Genetic analyses are under way to help clarify how distinctive the animals are and how they fit into the worldwide story of people and dogs.

People have long wondered about the circumstances that led prehistoric dogs to come, sit, and permanently stay, thus creating the first human-animal bond. Researchers have generally based their interpretation of the origins of the domesticated dog on archaeological records. In the past decade, however, molecular biologists have started to study canine DNA to trace the complex ancestry of the more than 400 dog breeds and related canine species.

Dog genes are telling a radically different story from dog bones. An analysis in the June 13 SCIENCE concludes that dogs were domesticated much earlier than archaeologists maintain. Instead of a 10,000- to 20,000-year time frame, Robert K. Wayne of the University of California, Los Angeles and his colleagues now have evidence that dogs could have been domesticated 100,000 years ago—if not earlier.

That conclusion has raised some hackles.

"I'm flabbergasted," says Brisbin.

"It's bound to be controversial because it's such an early date," says Marion Schwartz of Yale University. Schwartz's book, *A History of Dogs in the Early Americas* (Yale University Press), was released this month.

Other researchers find the result convincing, however surprising. The report "has really very compelling data," says Elaine Ostrander, a molecular biologist at the Fred Hutchinson Cancer Research Center in Seattle who is collaborating on a study of the dog genome. "It's a fascinating and exciting story."

Even the fossil record has triggered clashes of opinion. Fossil bones of dogs have been found along with human remains in caves around the world. Arguments have been made that dogs first became domesticated in the Middle East, Europe, or various sites in Southeast Asia.

The time frame, however, has not been controversial. The fossils at the proposed sites all date from between 10,000 and 20,000 years ago, times that slightly predate the origins of agriculture.

Many researchers supposed that these early dogs were descendants of tamed wolves, which interbred and evolved into a domesticated species. Other scien-

tists suspected that jackals or coyotes contributed to the dog's ancestry.

The new genetic study was unable to resolve the question of the dog's geographic origin, says Carles Vilà of UCLA, but it did rule out as the dog's ancestor all canine species other than the wolf.

The researchers analyzed DNA from 162 wolves representing 27 populations in Europe, Asia, and North America. The results were compared with DNA from 140 dogs representing 67 breeds around the world—from the African basenji to the Irish wolfhound.

The team collected either blood samples or hairs from all of the animals, then extracted DNA from those samples. DNA mutates over generations, and researchers use these changes to gauge the amount of time during which a lineage has evolved separately. The more similar two related sequences are, the less time the DNA molecules have had to mutate and the more recently the two species diverged.

Wayne and his colleagues looked at a segment of the cells' mitochondrial DNA, which is separate from the main, chromosomal DNA. Mitochondrial DNA mutates rapidly, making it useful for timing the evolutionary divergence of closely related species like dogs and wolves.

Based on the DNA sequences, most of the dogs could be assigned to one of four groups. The largest and most diverse group contains sequences found in the ancient dog breeds, including the dingo and the New Guinea singing dog, along with many modern breeds, such as the collie and retriever.

Other groups contained sequences—taken from the elkhound and German shepherd, for example—that were more closely related to certain wolf sequences than to those of the main dog group, bolstering the notion that dogs may have been domesticated from wolves several times. It's also possible, says Vilà, that domestication happened once, after which domesticated dogs bred with wolves from time to time.

What seems impossible, says Vilà, is that all the DNA variability evolved in the time frame usually assigned to domestication. "We have found so many differences in the DNA that the [dog's] origin cannot be 14,000 years ago," one of the commonly assigned dates for domestication.

That assumes, however, that the evolution of the small segment of DNA gauges accurately what was happening to the species overall. Such molecular clocks have been controversial, says Vilà.

The researchers do have an explanation for the older time frame that makes good sense, Ostrander says. Although the fossil record for dogs becomes obscure beyond about 14,000 years ago, there are fossils of wolf bones in association with early humans from well beyond 100,000 years ago.

Tamed wolves might have taken up with hunter-gatherers without changing in ways that the fossil record would capture. The dogs-in-process probably would have dallied with wolves as packs of humans and canines traveled the world.


S.E. Tucker

On a field hunt, Carolina dogs hold their curved tails up like flags. The position of the tail changes with the dog's mood or activity.

The influx of new genes from those crossings could very well explain the extraordinarily high number of dog breeds that exists today, the researchers suggest. Dogs have much greater genetic variability than other domesticated animals, such as cats, says Vilà.

Once people settled and started to farm, they might have begun selectively breeding their wolf-dogs into herders, guards, and different kinds of hunters.

"When we became an agricultural society, what we needed dogs for changed enormously, and a further and irrevocable division occurred at that point," says Ostrander. That may be the point—at which dogs and wolves were noticeably different physically—that stands out in the fossil record.

The little-known Carolina dog was not included in the large analysis by Wayne's group. The genetic analysis that's been done on the breed so far hasn't clarified its pedigree. William F. Gergits of Therion Corp. in Troy, N.Y., has found that at least one genetic marker present in dingos and other primitive dogs is missing in the Carolina dog.

Schwartz says that the dogs probably aren't direct descendants but are "very similar to types of dogs Native Americans would have had in that part of the country." She adds, "they do seem to be more primitive—what I think of as a basic dog."

The primitive dog that hung around Native Americans all but disappeared through interbreeding with European arrivals, says Schwartz, and probably with wolves and coyotes.

Still, the basic dog lurks in the gene pool of today's highly bred pet, as compelling to people in postmodern times as it was in the Pleistocene. □

Dog bites: One legacy of the dog's ancestry

It's been tens of thousands of years since canines went from predator to pet. Even though a dog's life now depends on its being adoring rather than marauding, the genetic links to its predatory forebears remain intact, in the tiniest toy poodle and the mightiest mastiff.

The close-knit pedigree of the dog (*Canis familiaris*) and the wolf (*C. lupus*) explains a serious and chronic problem. Each year, hundreds of thousands of people in the United States are bitten and seriously injured by dogs (SN: 6/18/94, p. 399). About a dozen people—mostly children—die of those injuries.

The exact number of dog bites is hard to pin down, since bites are usually just reported locally—and only if it's someone else's dog, says Jeffrey Sacks, a medical epidemiologist with the federal Centers for Disease Control and Prevention (CDC) in Atlanta. The available data, from two household surveys cited in the May 30 MORBIDITY AND MORTALITY WEEKLY REPORT, suggest that injuries from dog bites have gone up by about 37 percent in less than a decade.

Researchers estimate that 4.7 million people in the United States were bitten by dogs in 1994, resulting in 800,000 injuries requiring medical care. Those medical bills amount to an estimated $1 billion in insurance claims. An earlier report estimated that there were 585,000 serious dog bite injuries in 1986.

Much of the apparent increase may stem from a simple rise in the number of people and the number of dogs. "That's a big piece of the action," says Sacks.

Sacks and others point to irresponsible dog owners as the primary problem. "Any ill-bred, mishandled dog can be a biter," says Randall Lockwood of the Humane Society of the United States in Washington, D.C., who contributed to the CDC report.

As a graduate student in animal behavior, Lockwood studied wolves in Alaska. It was good training for his next study: dogs biting mail carriers in St. Louis.

Biting, says Lockwood, "is definitely a wolf behavior," but one that involves a specific set of cues. As predators, wolves chase and chomp down on small fleeing prey, which is why reports of dog bites often involve a running child. The best instruction for a child approached by a strange dog is to hold still.

"Part of the process of domestication has [entailed] turning the wolf into our teeth, our weapon. What we've done is taken away the wolf's natural control over biting and left it to the owner," says Lockwood. "That's where the problem comes from."

At the same time, the vast majority of the nearly 60 million dogs in U.S. households don't maim or kill people, adds Lockwood, but live in peaceable domesticity. —*C.M.*