

Science vs. Showmanship: Evolution and Anthropology of Dog Origins and Domestication

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Inter-professional scientific and medical thinking are changing, as all things must. Beyond the component of patient care, what elements of modern biomedical science might benefit from, and contribute to, a global One Health? In this discussion, I examine the evolution and anthropology of dog origins and domestication.

Historical influences on population and disease development are becoming increasingly valued tools for understanding contributing elements of 21st century population health. Health complications in many contemporary purebred dogs reflect human interventions. However, as we look for underlying influences, are we asking the right questions from informed perspectives and with the right motives? With One Health ideation now well in hand, can we apply its principles retrospectively?

Where was the domestic dog domesticated? Who did the domesticating and when? Did domestication occur directly from populations of gray wolves, or were there intermediate canid populations that we cannot yet distinguish? Was dog domestication a conscious effort by humans, or did it occur like much of evolution, as successes that just happened to occur in the right place(s) and at the right time(s)?

The story of the origin and domestication of the dog is hugely confused and controversial, as indeed is the structure of the genus *Canis*. While there is no shortage of strong opinion, is there a shortage of truly reliable data? It is commonplace and very tiresome that some (thankfully not all) researchers take data that are scientifically preliminary *at very best* (a small piece of bone or a fragment of DNA) and construct a new view of a species phylogeny or even a new evolutionary tale.

Is it justified to acquire minimalistic evidence and create glamorous stories for popular media? For example, can a fragment of bone really characterize a previously un-described species, without knowing whether said specimen represents a normal structure, an environment-based adaptation or simply-inherited genetic modification, a taphonomic alteration, or a disease-related pathology? Similarly, we see phylogenetic mathematical models that are based on multiple biological assumptions that may or may not be accurate (mostly ‘maybe but not really’).

How should we change our thinking about scientific publication? We can read the sweeping genome study that yields huge data volumes and putative target-associated loci on chromosomes, in a large enough population to assure ‘amazing’ outcomes that actually are just **obligate** output of the experimental designs. Then, if one has a reasonable genome map, one likely can find some gene(s) that code for something or other that associates in some way with what one is studying (usually a vaguely connected metabolite that most probably has little to do with anything). What invariably follows is a pedantic debate about who is correct, not to mention the continued bilking of the

scientific funding system in career-assuring proportions, so that ‘these important questions’ can be resolved.

Many decades ago, Professor Harold Broadbooks of Southern Illinois University, probably the best teacher that I ever had, taught me that scientific progress occurs only at the clash of opposing opinions. While I believe that this is true in the case of ‘honest difference of opinion’, two thoughts now come to mind: (a) the opposing ideas of today too often are nothing more than byproducts of poor experimental designs, despite all of the hand-waving by their proponents; (b) the anticipated scientific progress will not occur as long as sensational science persists as the norm.

What damage is caused by these politically (financially)-motivated machinations? Propagation of pseudoscience, such as ‘the earliest dog’ or ‘the earliest site of dog domestication’, ingrains a repeatable story into memories, soon resulting in the showmanship element becoming the common knowledge. Sadly, some highly impactful scientific journals seem to fall prey to these over-extrapolated research reports with distressing regularity.

This is not to say that such work should not be done. It is important to understand historical aspects of environment-disease relationships, so that we can be positioned effectively to address new concerns that will arise in a changing global climate. So, let us consider a new perspective. We now live in a world where inter-professional (One Health) collaborations increasingly are critical to understanding our ecological surroundings and how we will manage population-based health problems in our near future. The history of any trait or disease, including relevant phylogenetic history, informs about its behavior in populations. We cannot accomplish health-related or other scientific goals efficiently, or even correctly, without engaging across biomedical disciplines. The issues themselves have become vastly more complex and interdisciplinary in a rapidly changing world of science (and politics and finance). Here is the key: No discipline can provide complete answers in an unaided fashion.

Returning to the present focus, what does One Health thinking have to do with where, when, and how domestic dogs arose and tracked toward domestication? My colleague Dr. Angela Perri recently pointed out to me the need to “include ecologists and paleobiogeographers in the study of archaeological findings and genomic aspects of dog origin(s) and domestication(s)”. Dr. Perri also offered the caution that we do not yet fully grasp even something as basic as whether various “biological data from modern gray wolves (*Canis lupus lupus*) are valid proxy for exploring the nature of the ancient gray wolf”.

Considering together the growing numbers of publications that diverge on the subject of dog origin(s) and domestication(s), we could begin again by re-hypothesizing. For example, sans the media sensationalism, present evidence suggests that domestication of dogs from gray wolf ancestors most probably occurred in fits and starts, with successes and failures, over significant periods of time. In fact, Professor Greger Larson and colleagues, including co-author Dr. Perri, have evaluated these ideas in a well-written and thought-provoking report.

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By the time humans crossed the Bering Strait to what is now North America, starting about 14,500 years ago, dogs almost certainly were domesticated or well on the way to domestication. However, my geologist/archaeologist colleague Dr. Christopher Widga (East Tennessee State University) points out that “dogs were domesticated ‘somewhere’ by the time humans entered North America. But we have no physical evidence of any dogs that they brought with them”. Dr. Widga also notes that the earliest domestic dogs known in North America date from about 10,100 years ago by the most recent

assays, whereas there is good evidence of a human presence around 14,500 years ago. Is the dog-related evidence still at the bottom of the Bering Strait? Were dogs domesticated again in North America between 14,500 and 10,100 years ago? If so, what and where was that originating population? Did some dogs somehow arrive in North America in ways that are not yet recognized? In present context, 4,400 years is a lengthy period of information deficit.

Back still further in time, what is a reasonable estimate of when dog domestication occurred in its first formative stages? This too remains an open question. Mere associations of dog-like bones with human habitats are minimalistic observations from which one cannot extrapolate domestication. Such a specimen may be a presently-unrecognized intermediate subspecies, a somewhat more developed domestic dog progenitor, a scavenging bystander, or even a hunted meal. Another problem with ancient *Canis* specimens and domestication 'theories' is that no reliable method presently exists by which to attribute behavioral traits that must accompany implications of domestication. Once again, we can ask whether said behavioral traits of modern domestic dogs are fair proxy for ancient comparisons. Well, on that subject, read on, dear reader, read on!

Now armed with new insights, we fast-forward to modern domestic dogs and their semi-domesticated humans. Larson and colleagues demonstrated that no modern dog breeds can be traced to an ancient dog lineage (like several thousand years or more). This group of investigators further point out that reproductive isolation, often enforced by geography and/or humans, can be and has been misinterpreted to suggest ancient lineage. An important implication of the Larson et al. perspective is that modern dog breeds are human constructs that do not inform about deep time lineage of domestic dogs or their ancestry, except generally as being derived from wolves. By contrast, the ancient dogs very likely can inform about modern human errors of intervention.

Another important related detail is that we no longer are talking about simply-inherited traits that were described by good old Gregor Mendel, of late spinning in his grave. No, No! We are talking about traits and diseases that involve numerous-to-many genes (usually altogether accounting for only small portions of the total trait or disease variability in a population to begin with, as is most typical for such traits that are inherited quantitatively). In this respect, did I mention that the 'showman scientists' cannot make money from the external and internal environmental causes that in actuality characterize the bulk of the variability of most quantitative inheritance? Neither can their universities.

Most genomic and archaeological scientists (and many other scientists as well) seem to be missing the modern critical need for inter-professional studies. Let us coin a maxim: '**collaborate to corroborate**'. Arrogance is an insidious enemy in a race for professional recognition, the glory of the front page photograph, and (repeatedly) renewed research funding. The money is flying away in truly biblical proportions, but does one see waters being parted or walked upon?

Why does all this matter to the health of humans and animals today? In the interests of good science and appropriate service to animals and to human societies, should we not look much more closely at inter-professional approaches to complex biological and biomedical problems? We would if we were smart. And, in the interest of optimal One Health scientific practices, is it time to relinquish scientific showmanship? Yes, it certainly is.