Molecular Analysis of ‘Anomalous Primate’ Hair Samples: A Commentary on Sykes et al.

While the correct logical formulation of a scientific hypothesis test is taught to virtually every child in their secondary school curriculum, the manner in which scientific researchers approach the resolution of questions concerning the cause(s) of natural phenomena is often misunderstood and/or misconstrued by the general public, usually aided or abetted by media reports that ‘scientists have proved’ this or that. With the exception of discoveries of species, minerals, compounds, etc., new to science, or known to science but found to occur at a place or time previously unanticipated, very little is ‘proved’ by science. Indeed, even in these cases all that is proved is that the phenomenon exists or existed at the place and time where it was found. The day-to-day work of most scientists lies not only with the discovery of new phenomena and/or occurrences, but also with the seemingly more mundane, though infinitely more complex, task of interpreting nature: how did the processes and objects we see in nature come to be? How do they function? What influences them and what do they influence? In statistics (which is often used as a tool for testing scientific hypotheses), the hypothetico-deductive formalism scientists most often used to explore these issues is enshrined in the concept of the null hypothesis which states that there is no relationship between two observed or measured phenomena [1]. Thus, in R. A. Fisher’s classic ‘lady tasting tea’ experiment, the ability of the lady in question (Dr Muriel Bristol-Roach) to determine whether the milk was placed in the cup before or after the tea was evaluated by performing a series of randomized blind tests, recording the number of correct identifications and determining whether this number was sufficient to preclude the null hypotheses that they were obtained through random guessing. If the null hypothesis cannot be refuted no alternative hypotheses need be sought.

In the case of cryptozoology, its proponents have, for many years, claimed that the scientific establishment has failed to live up to the tenets of its own philosophy by failing to acknowledge the evidence they have offered for the existence of large species presently unknown to science. In most cases, scientific researchers have regarded this evidence—typically anecdotal observations recounted by individuals backed up on occasion by photographic and/or sound recordings, usually of quite poor quality—as hopelessly ambiguous and so not suitable for rigorous hypothesis testing. In such cases, the ‘evidence’ that links the observation with an unknown species (the alternative hypothesis) can be attributed reasonably to lack of familiarity of the observer with the regional biota, uncharacteristic behaviour of a known species, unusual lighting or fraudulent staging. In cases of ambiguous evidence such as these the null hypotheses of no link between such evidence and any unknown species is accepted because it cannot be refuted specifically. This stricture also applies to certain types of ephemeral physical evidence (e.g. trackways) that have often been documented photographically.

Of a different character altogether, however, is direct physical evidence in the form of bodies or body parts. These could, in principle, be compared with the body parts of known species and identified unambiguously as either having a combination of characteristics known to occur in a species described previously (the null hypothesis) or a set of characteristics of sufficient novelty to warrant establishment of a new species (the alternative hypothesis). Scientists who have looked into the claims of cryptozoologists have often been struck by the lack of such physical evidence in the form of collected individuals, dead bodies, fossils and/or parts thereof. This lack of direct and unambiguously testable evidence supporting the recognition of animals such as the yeti, Loch Ness Monster, and Morag, not to mention sewer alligators, and the various beasts of Bodmin, Dartmoor, Exmoor and Dean, is the primary reason why many regard cryptozoology as a pseudoscience that accepts the existence of species in the absence of unambiguous physical evidence relying instead on personal observation, anecdote, legend and myth.

Until recently, hair samples reported to have been collected from areas where mammalian cryptozoological species are suspected to have occurred fell into this category of ambiguous evidence owing to the lack of morphological characteristics sufficient to rule out the possibility that they could be derived from extant species. However, owing the recognition that naturally occurring hair samples often include bits of skin and parts of hair follicles, the cells of which contain DNA, along with current DNA sequencing technologies, this physical evidence has moved out of the category of ambiguous, untestable evidence and into the realm of scientifically acceptable physical evidence that can be used, at least in principle, to identify unknown species. The reason for this alteration in the status of hair samples is that DNA sequences recovered therefrom could, in principle, be compared with those of extant species and the null hypothesis that the hair sample was derived from a species already known to science tested empirically.

The results of such tests on a series of 37 hair samples reported anecdotally to come from cryptozoological species is the subject of the Sykes et al. [2] article in this issue of the Proceedings of the Royal Society. These 37 samples were a subset of 58 samples submitted to the Sykes team for analysis. Of these 58 samples, two were excluded as being non-hair and 37 of the remaining 56 samples were selected for DNA analysis. The 19 samples excluded from DNA analysis were so designated for a variety of reasons including budget constraints, prioritization of samples of particular historical interest and amount of material available. In this reduced sample, seven of the samples selected for sequencing yielded no DNA. However, all of the 30 samples that did yield DNA contained base-pair sequences that were 100% compatible with known mammal species, though in certain instances the hair sample was reported to have been obtained from a region well outside the species' known geographical range. In two instances (samples 25 025 and 25 191), the gene sequence matched not an extant species, but a fossil sequence obtained from a Pleistocene polar bear (Ursus maritimus). As polar bears are not known to occur on the Tibetan Plateau, the Sykes team speculate that these samples may have come either from a previously unknown bear species or possibly from a hybrid between U. maritimus and the brown bear (Ursus arctos). Viable hybrids of these species are known to occur in North America. A hybrid between two known bear species does not conform to the model offered by cryptozoologists to account for these samples, though if a hybrid bear species does occur in this region it may explain some of the anecdotal observations reported by individuals.

Does this evidence disprove the legends of the Yeti, Migyhur, Almasty, Sasquatch/Bigfoot? It does not. Scientific hypothesis testing of this sort is not designed to, and cannot, prove hypotheses alternative to the null hypothesis. All that can be said with confidence is that the results obtained by the Sykes team for the 29 samples that yielded DNA sequences failed to reject the null hypothesis that these samples came from species already known to science. Interestingly, despite the fact that most cryptozoologists have suggested the cryptids in question are unknown primate species, not one of the Sykes team's sequences yielded DNA that could be shown to have come from any nonhuman primate. Nevertheless, 19 of the original 55 bona fide hair samples submitted originally to the Sykes team did not produce DNA sequences. The taxonomic affinity of these samples remains unknown and science has nothing further to say about them, at least for the moment. From a scientific point of view, these samples return to the category of ambiguous evidence insofar as they cannot offer any unambiguous information that can be used to refute the null hypothesis of no link to any presently unknown (primate) species.

On a more general note, and as the Sykes et al. [2] report mentions in its last paragraph, this type of analysis opens the way for cryptozoologists and mainstream biological zoologists to enter into a productive dialogue. Cryptozoologists must now either accept the findings of the Sykes team or show where they are in error. Mainstream zoologists must also now recognize that, in the case of hair samples, the claims of the cryptozoological community are now amenable to scientific testing and potential verification. In this area, these two communities can and should speak the same language, the language of hard scientific data and hypothesis testing. Will this ultimately lead to the recognition of new large mammalian species in out-of-the way corners of the world? No one—certainly no scientist—can say for sure. What we do know is that scientific discoveries just as strange and unexpected as those advocated by cryptozoologists in these cases have happened before (e.g. the coelacanth [3] and the okapi [4]).

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