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Unearthed within the limestone quarries that lie east of Dusseldorf in Germany, the first fossil to be recognized as an ancient hominin brought solid evidence to the table for starting to find answers to the question of where humans came from.

The fossil—known as Neanderthal l—has since been classified as Homo neanderthalensis, named for the location of its discovery in the Neander Valley (that being the spelling of the German word for 'valley' prior to the German orthography reform). Prior to the discovery in 1856, the subjects of human origins and evolution were no strangers to science. Charles Darwin published his most famous work, On the Origin of Species, in 1859—three years after the discovery of Neanderthal 1, though his hypothesis of natural selection had been conceived much earlier (and even simultaneously 'discovered' by Alfred Russel Wallace).

Kurt Vonnegut's novel Galapagos gives a fictional example of how speciation can occur over time once specific traits are exemplified over the course of the evolutionary process. In the book, through a case of genetic mutation and a significant degree of genetic influence from the (somewhat) apocalypse-induced founder effect—the seeds for the genetic future of all human descendants are sown.

Vonnegut's novel shows an extreme and isolated case of how natural selection and genetic variation can influence the future of a species, but this process is not something unfamiliar to anatomically modem humans—as it has influenced the predecessors of the current implementation of our species and our now-extinct cousins for millions of years.

The passengers of the Bahia dc Darwin, swept away to an isolated island of the Galapagos-—mirror, in a sense, the journey of our most recently extinct human cousins—the Neandertals. Hominid fossils from earlier than [.8 million years old have not been found outside of Africa to date (Hoffecker, 21). Some of the oldest fossil hominids found outside of Africa, in Europe and the Middle East—belong to the species of Homo known as Homo heidelbergensis. Named for the city of Heidelberg in Germany—nearby to the site of the first H. heidelbergensis fossil's discovery in 1907, this species is estimated to have lived roughly 600,000 to 200,000 years ago—and is widely agreed upon as the likely common ancestor for anatomically modern humans, Neandertals and Denisovians.

Support for this hypothesis is found in the estimation that modern humans and Neandertals diverged genetically around 690,000 and 500,000 years ago (Hoffecker, 49)——the idea being that the populations of H. heidelbergensis migrating through the Middle East and Europe, evolving over hundreds of thousands of years, accounts for the first "out of Africa" wave that resulted in the speciation into what we know as Neandertals.

While Neandertal predecessors were speciating out in Western Europe, the remaining H. heidelbergensis populations left on the African continent evolved separately into the first groups of anatomically modern humans—some of which would eventually make a similar migration though the Middle East and Europe in a separate "out of Africa". After the relatively recent study in 2010 by the Max Planck Institute proved that Neandertals and anatomically modern humans had indeed interbred—the question of whether these two species of humans were ever contemporary to each other within the same environment was finally able to be put to rest.

Still, with this initial sequencing of the Neandertal genome in 2010—more questions were brought along with the findings of the study. Researchers at the Max Planck Institute for Evolutionary Anthropology concluded that in anatomically modern humans with ancestry from outside of Africa, there was the potential to have up to two percent of DNA from the up to four billion base pairs within the Neandertal genome (Green, et al., 2). This initial study, that used the DNA from three female Neandertal individuals compared to the DNA of five present day humans (Green, et al., 3), though a remarkably small data pool—managed tc reveal a great amount about human origins and proved that anatomically modern humans and Neandertals interbred.

Though they do not often occur in the wild, hybrid animals are not unfamiliar to humans—and many only exist as the result of human meddling in the breeding of creatures raised in captivity. A hybrid is technically defined as "an organism resulting from fertilization of the egg of one species with the sperm of another," (Bonnicksen, 59)—as such, though few instances occur in the wild, some of the complications that arise in the hybrid offspring created by the whims of humans can shed some light on some c the perceived complications that would have hindered the reproduction between Neandertals and anatomically modern human:

One hybrid animal most famously 'engineered' though breeding in captivity is the liger, the product of a male lion and a female tiger (and less commonly, the tigon—the product of a female lion and a male tiger). The breeding of ligers and tigons is hindered by a number of complications from the millions of years of evolution that these two species, and many attempts to produce one are unable to survive to term. Putting these cases—and the slew of health problems afflicting hybrid animals aside to us on the few that manage to survive to sexual maturity—brings up the topic of hybrid offspring: sterility.

All male ligers are sterile—a result of incompatible Y—chromosomes. While female ligers can bear offspring, it is not an occurrenc frequent enough to be studied—much less enough to cultivate the speciation in a population. These modem-day hybrids, while a result of human tampering, can still give a rough idea of issues that might have caused complications in the pairings between anatomically modern humans and Neandertals—though with a point of divergence of roughly 500,000 years prior instead of abou 7 million. A report published in The American Journal of Human Genetics in 2016 concluded that the Y chromosome from the DN of the 49,000 year old male Neandertal found at El Sidron, Spain—"diverged from those of modern humans" (Mendez et al., online). Succinctly put in Ann Gibbons review of the report for Science Magazine, "though male Neandertals and female modern humans probably hooked up more than once over the ages, they may have been unable to produce many healthy male babies." (Gibbons, online). The many discoveries over just the last decade in the field on human origins have raised more questions than they have answered—namely raising the issue of whether Neandertals should be considered a sub-species of H. sapiens (thus, sometimes referred to as H. sapiens neanderthalensis).

This revision would make better sense from an evolutionary standpoint, as hybridization between sub-species in the wild is more common—especially in times of environmental instability, such as climate change (Actman, online). This occurrence today lends to some interesting implications of the nature of anatomically modern human-Neandertal relations during their contemporary years (the topic of which will have to be left for further speculation in future research, hopefully).

These scientific revelations have proven that many humans alive today may be distant descendants of hybrid offspring—but the fact that Neandertal DNA exists in modern humans brings to mind more questions than answers. Neandertals, though not surviving as their own species—were not entirely lost to evolution. To current knowledge, at least some Neandertal individuals fulfilled their evolutionary goal of ensuring the passing-on of their genes. We—as humans, as scientists, and so on—have an idea of at least the basic logistics of where these hybrid ancestors fit into the human story, but it is still developing.

Perhaps, if we are lucky—more light can be shed on the nature of these relationships, and the interactions between populations of anatomically modem humans and their contemporary Neandertal cousins.

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