

## *Proudly Alone*

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### **How Many Human Species Have There Been?**

Proudly alone: for most of recorded history, our species believed itself to be so unique on planet Earth as to bear no relation whatsoever to any other species of animal, and therefore to be a very special form of life. Creation stories around the world tell of men and women being born from eggs, shells, bodily fluids, dust and clay, but always distinct from the rest of the planet, and especially in the best-known myths of the Western world – humans are seen as an indispensable accessory to the life of our species. It was possible to recognise similarities between similar species of animals or plants; between seagulls, mice, wild beasts, or fir trees, and the like. But even the animals most similar to us – monkeys, for example – were placed in categories distinct from the one to which only we belong. The famous representation of the entire system of living beings as a «ladder of nature» (*scala naturae*) always places our species at the top, above angels and deities if we count them too, but detached from the rest of the animal world,<sup>1</sup> even though a certain anatomical similarity between us and other species could not be denied, particularly after the discovery of what we call anthropoids, or higher primates. Chimpanzees, gorillas and orangutans seemed, however, to be caricatures of humans, brutes created perhaps to warn us of an animalistic nature that we had left behind, but which we always risked falling back into. The first person who, with extreme objectivity despite his religion, placed the human species a little closer to animals was Linnaeus. He gave women and men a binomial definition, as he did for all the other species he described, calling them *Homo sapiens*. However, this implied that the undeniable anatomical similarity with higher primates could not be taken as a symbol of mental closeness to them. The only wise, intelligent species was us. We moved from external anatomy to a deeper and more essential distinction, one concerning the mind, brain, and consciousness. The leader of this

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<sup>1</sup> An introduction to the concept of the *scala naturae* can be found in LOVEJOY – A.O. “The Great Chain of Being” [Italian translation by L. Formigari, *La grande catena dell'essere*, Milano: Feltrinelli, 1966].

method can be considered René Descartes, a 17th-century French philosopher. Descartes applied a rational approach to knowledge and specified that the only way to «be» is to think (to clarify, he said *cogito ergo sum*). Since the human being is the only species that thinks, this means that other species – animals and, clearly, plants – cannot «be». Obviously, they are not thinking beings; they have no consciousness at all (here thought is equated with consciousness, which is not entirely correct). So how do they act? The answer is that they respond to external *stimuli* only in a stereotypical manner. They are small (or large) robots that respond to a kick with a yelp and flight, and to hunger by searching for food. From certain points of view, they are what are defined as «philosophical zombies» – beings that, in a thought experiment in the philosophy of mind, are physically identical to normal people but have no conscious experience. They are only *res extensa*, he said, material substance that reacts but does not act. This is contrasted with *res cogitans*, thinking matter, i.e., us.

## **Instilling Doubt**

Decades of not only direct observation, but above all a theory that explained all the others, changed the mind of science and, much more slowly, humanity. The first significant push came in the nineteenth century from various theories that sought to explain why there are troubling similarities between humans and certain animals, and not only from a physical point of view. The hypotheses put forward by scholars such as Erasmus Darwin and Étienne Geoffroy Saint-Hilaire, and then more comprehensively by Jean-Baptiste de Lamarck, tended to place our species within the dynamics of the transformation of living forms over the centuries. And if the derivation of the species *Homo sapiens* could be compared to other animals, perhaps its thoughts and theirs were not so far apart after all. The complete theory that could convince everyone – not only biologists but all intellectuals – that our species and other animals are not just physically similar, is what we call the theory of evolution by natural selection, outlined by Charles Darwin and Alfred Wallace.<sup>2</sup> Darwin himself tried to bridge the mental gap between *Homo sapiens* and other species with a memorable phrase that was shocking for the time, and is still perhaps so even now), that the

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<sup>2</sup> DARWIN, C. *On the Origin of Species* [*L'origine delle specie*, trans. by L. Frantini, Torino: Bollati Boringhieri, 2011].

difference between humans and other animals is «one of degree and not of kind». He then applied his hypotheses to the origin of our species. Sweeping away the difference with a single stroke of the pen, in his book *The Descent of Man, and Selection in Relation to Sex*<sup>3</sup> he suggested that our ancestors were contemporaries of those of gorillas and chimpanzees. And since these latter anthropoid apes are African, it is quite obvious to think that the species from which we descend also inhabited Africa.

### **The First Fossils**

At the time of the publication of Darwin's book, the «race for our ancestors», the competition to discover who had preceded us, had already timidly begun. The first true fossil of a species belonging to the «human» group can be considered the so-called «Gibraltar skull». Discovered in 1848, it was not recognised as different from modern humans. That title belongs to another find, namely the so-called «Neanderthal 1 skullcap». Found in the Neander River valley in Germany in 1856, it was variously attributed to an individual who was more or less deformed or ill (even a Cossack from the Napoleonic Wars). But in the end, the fossil was classified as «Neanderthal man» and given a binomial name like all other living or extinct species: *Homo neanderthalensis*. With it, palaeoanthropology, the study of our ancestors, was born. Since then, discoveries have followed one after another, although not as frequently as palaeoanthropologists would have liked. The territories to be covered were too vast, the period in which to conduct research too obscure and undefined, and the means of research too primitive. In 1891, Eugene Dubois, a Dutch physician and anthropologist, discovered part of a human skull in Indonesia. This reignited the controversy over the true origin of our ancestors: Asia or Africa? At the beginning of the last century, the African hypothesis gradually gained strength with the discovery of new fossils of species similar to ours or apparently «halfway» between us and other anthropoid apes. There was also suspicion of a European ancestor, but this turned out to be a hoax, the details of which remain unclear. Called the «Piltdown Man», the hoax probably arose from a desire to include

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<sup>3</sup> DARWIN, C., *The Descent of Man, and Selection in Relation to Sex* [L'origine dell'uomo e la selezione sessuale, Italian translation by P. Fiorentini and M. Migliucci, Roma: Newton Compton, 1990].

England among the countries where a species belonging to our ancestry had lived.

### **Africa Bursts Onto the Scene**

Meanwhile, the number of species more or less similar to *Homo sapiens* was increasing, with fossils found mainly in Africa and less frequently in Asia, particularly China, or Europe. From 1924 to the 1990s, the discoveries concerned species that can be grouped into three categories. And so very distant ancestors were discovered, close to the moment when the line that would lead to where modern humans branched off from chimpanzees and bonobos; to species closer in time, belonging to the genera *Australopithecus* and *Homo*; and to more robust species, which are now classified under the genus *Paranthropus*. Gradually, the scene became crowded with fossils: many were skulls or parts of skulls; some were fragments of body bones, which are less revealing; and very few were almost complete skeletons. Among these, the most spectacular belong to the species *Australopithecus afarensis*. Discovered in Ethiopia in 1975 – about 50 years ago – they are the remains of a girl, 40% complete, thus a very high percentage. Together, these fossils told a story of transformation, evolution, and even profound changes in habitat. Some species responded to these changes with very particular adaptations, while others clung to their original ecosystem, one might say. The changes took place mainly in East Africa, in the long, wide strip of territory stretching from Ethiopia to South Africa, passing through Kenya and Tanzania. These are the best-known countries of Africa, with their savannahs and lions, Masai, and elephants. Until about six to seven million years ago, this environment did not exist; the territory was covered by a denser forest, not very different from that now found in Central Africa. The primate species that inhabited Africa at the time had a body structure that was clearly more suited to moving between branches, with occasional movements on the ground, to reach the trees that were most interesting for shelter or food. Changes in sea currents, shifts in tectonic plates, global cooling of the climate, and the establishment of the so-called Walker atmospheric circulation caused East Africa to become arid. Some species disappeared, while in others, evolution modified their body structure to allow them to live in more open environments, such as the wooded savannah. The most revolutionary achievement was the acquisition of upright posture and walking on sturdy hind limbs. This freed the hands from the task of walking. The body became taller and

slimmer, the rib cage wider and less barrel-shaped, and the arms shorter. But above all, the skull moved into a completely vertical position relative to the spine, unlike that of other anthropoid apes and other more or less quadrupedal animals. The diet and structure of society also changed more or less radically. From grasses, flowers and fruits, nuts and other foods, they moved on to tubers – richer in starch – until they became more or less completely dependent on meat. The tribes themselves expanded to include dozens and dozens of people who were more or less related to each other. A greater number of hunters allowed for more effective hunting, and larger animals were killed, providing more and more individuals with pieces of meat. The latter provided the bodies of the species that had become carnivorous with important fuel for brain development. This was most likely driven by the need to know the relationships of kinship, friendship, and hostility with all other members of the tribe.

### **From the Branch to the Bush**

Described in this way, the succession of discoveries could be described as a long series of species that are increasingly distant from the original ones in terms of structure. One after another, they are increasingly different from the ancestors we share with other anthropoid apes, particularly chimpanzees and bonobos, constituting a line of «improvement» towards absolute perfection which obviously consists of *Homo sapiens*. Even in light of the discoveries, this scenario which was shaped by the theory of evolution does not stray too far from concepts such as the «ladder of nature» that we saw earlier. And in fact, one of the most important evolutionists of the last century, the German Ernst Mayr (1904-2005), thought the same way: one species after another would replace their predecessors in the great African territory. However, given his strict Darwinian alignment of course, he did not consider the later species better than the earlier ones. Rather, what Mayr proposed is the same model we see in the most famous depiction of human evolution, represented by a line going from an ape to modern man (white and male) via a hunched *Australopithecus* and a fur-covered brute, probably an ancestor belonging to our own genus, *Homo* – all very nice, very satisfying, and extremely gratifying.

### **A Plethora of Humans – and Not Humans**

But this model is definitely wrong. The discoveries that have followed since the 1970s have completely overturned this model. No longer is

there a continuous succession of species, each more «evolved» than the last, there is instead a multitude of life forms, replacing the linear structure with one in the form of a bush. Therefore, contemporary species belong to different evolutionary lines, even though they share a common ancestor. The famous Lucy (the *Australopithecus afarensis* fossils discovered in Ethiopia in 1974) who lived around 3 million years ago, for example, was not the only species of the *Australopithecus* genus – and others – to live in Africa.<sup>4</sup> Almost contemporary with Lucy, another australopithecine (*Au. africanus*) has been described. And in fact, in the same territory as *A. afarensis*, a species of the genus *Kenyanthropus* also lived. The same is true of the *Homo* species, which are far more numerous than the three or four we learned about at school: textbooks limit themselves to *Homo habilis*, *Homo erectus*, and *Homo neanderthalensis*, ending with our own species. However, the «bush» has been enriched with other fairly certain species, such as *Homo heidelbergensis* or *Homo ergaster*, as well as others yet to be confirmed, such as *Homo rudolfensis* or *Homo antecessor*.<sup>5</sup> According to Andra Meneganzin, philosopher of biology at the University of Leuven in Belgium, the dawn of the *Homo* genus is much more complicated in terms of the data and processes involved, even with «diamonds» in the fossil record, such as *Australopithecus afarensis*. The period from three to two million years ago is still a critical window, which explains the importance of the finds at Ledi Geraru. These finds, discovered in Ethiopia in 2013, seem to have added yet another species – or perhaps two – to the plethora of human forms present in the territory. As seen above, species are sometimes contemporary and coexist in the same place, perhaps even with other «humans», the more robust ones of the genus *Paranthropus*. Meneganzin also states that: «The coexistence of different genera (*Homo*, *Australopithecus* and *Paranthropus*) is clearly interesting from an adaptive point of view (i.e., how and in response to what pressures evolution shapes species, Ed.) and indicates that in

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<sup>4</sup> An introduction to this discovery can be found in A. Meneganzin: “Cinquant’anni di Lucy, molto più che uno scheletro.” *Le Scienze*, November 2024 [*Fifty Years of Lucy, Much More Than a Skeleton*].

[https://www.lescienze.it/news/2024/11/22/news/lucy\\_australopithecus\\_homo\\_origin-i-17754038](https://www.lescienze.it/news/2024/11/22/news/lucy_australopithecus_homo_origin-i-17754038)

<sup>5</sup> Many books tell the story of our species and those that preceded us, among others: BARBUJANI, G. *Come eravamo, storie dalla grande storia dell'uomo*, Bari: Laterza, 2022 [*The Way We Were, Stories From the Great History of Man*].

human evolution, contemporary experimentation with forms, as has happened in more recent evolution, is far from an anomaly».<sup>6</sup>

### **Critical Moments**

With this scenario of human and non-human species, the palaeoanthropology community has long been rethinking the dynamics at play in our evolution. Having obviously abandoned the concept of «better» or linear evolution some time ago, we are now beginning to think about the boundaries between one species and another. There are two or three particularly important moments: the transition period from *Australopithecus* to modern humans, the period shortly before the birth of our species, and the thousands of years of coexistence with two other decidedly human species, Neanderthals and Denisovans, described in 2010 on the basis of a few bones discovered in a cave in Siberia. So many species! Together with those listed above, for some, there are too many. In reality, the numbers vary greatly, and with the help of philosophers, this fragmentation is called into question. Meneganzin ironically remarks: «In a shameful summary, I would say that the species recognised by consensus today are on the order of twenty, reaching over thirty if one is a maniacal hairsplitter [a scientist who tends to divide fossil finds into as many different species as possible, Ed]. But the relevant question concerns the criteria for delimiting species that underlie more conservative or more species-rich taxonomies».<sup>7</sup>

Discussions in the world of palaeoanthropology now focus on this very issue, touching on one of the hottest topics in the philosophy of biology: what is a species, and how do we describe it? There are dozens and dozens of definitions of species, and they change according to need. The most classic definition dates back to Ernst Mayr (the same Mayr as the line of human evolution mentioned above) in 1942, who stated: «species are groups of interbreeding natural populations that are reproductively isolated from other such groups». This is the so-called «biological species concept». Over time, other concepts have been added, such as the morphological, ecological and evolutionary concepts. In the case of fossils, these ways of looking at things are unworkable, as it is impossible to see species mating when we only have fossils. What could be applied was the concept of chronospecies, forms

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<sup>6</sup> Interview with the author.

<sup>7</sup> Interview with the author.

of life that follow one another over time. Menegazin responds to the problem as a philosopher: «Philosophers have long debated the concepts of species and the need to adopt a pluralistic approach to classification depending on the context and the organisms involved. In palaeoanthropology, however, I do not believe that the application of different concepts of species is at the root of differences of opinion, but rather different conceptions of the process».<sup>8</sup> But it is necessary to have a starting point, and some of her recent work also speaks of the need to clarify the process of speciation. According to a 2024 article by Menegazin and Stringer: «[Speciation is] an evolutionary process that starts in space, thereby involving a geographic dimension, and progresses over time, thereby involving a diachronic dimension, with an incremental accumulation of relevant characters at different phases of the process».<sup>9</sup> No longer do we have the description of individual fossils as if they were frozen in a precise moment, but a trend to be followed over the thousands or millions of years that separate us from our first «certain» ancestors. Is this possible? Luca Pagani, who teaches molecular anthropology at the University of Padua, looks at it all from the point of view of a biologist whose job is to describe species: «The biological species as we know it deals with finite entities, such as dogs, pigs, etc. But here we are talking about an ongoing process, namely evolution (human or otherwise). We are also trying to understand whether “asynchronous” individuals – i.e., those who may have lived a hundred thousand years apart – are the same species or not. With such a broad time frame, we are really stretching the concept of species». The biggest problem is the fact that we have very long timelines, a *continuum*, on which species exist, of at least two million years from *Australopithecus* to us, for example. When and how do we find the solution of continuity in this succession of individuals, each of whom is only slightly different from their father or grandfather? «You can find dozens of species, or none at all. It depends on how you divide the line of ancestors» comments Pagani.<sup>10</sup>

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<sup>8</sup> Interview with the author.

<sup>9</sup> MENEGAZIN, A. – STRINGER, C. “*Homo sapiens*, Neanderthals and Speciation Complexity in Palaeoanthropology.” *Evolutionary Journal of the Linnean Society* 3, 1, 2024.

<sup>10</sup> Interview with the author.



## What Genes Tell Us

Another point of contention arises when we manage to obtain fragments of the genetic heritage of species. We have the complete genomes of modern humans, Neanderthals and Denisovans – a series of populations that lived in Central and Eastern Asia between 400,000 and 30,000 years ago – and we can compare them. This is where the problem of distinguishing between *Homo sapiens* and Neanderthals (also discussed in the article by Meneganzin and Stringer) comes in. We are certain that our two species are on two different branches, but if we base ourselves on Ernst Mayr's definition, then we, Neanderthals and Denisovans are the same species. This is because in Western Asia and perhaps Eastern Europe, modern humans and Neanderthals interbred and produced fertile offspring.<sup>11</sup> The same thing happened in Central and Eastern Asia with the Denisovans. In the genomes of women and men outside Africa and their descendants, there is always 2-4% of genes that belong to Neanderthals. And in the populations of Papua New Guinea, Denisovan genes are present in even higher percentages. Neanderthal genes make up at least 30-40% of our genome; this means that they are not just fragments of genes that evolution has «purified» over time, thus excluding them from our genetic heritage. On the contrary, they are very often coding genes, and therefore influence our appearance and, above all, our metabolism. Defining groups of populations that have mated and produced fertile offspring as different species is therefore, from certain points of view, incorrect. So much for genetics. If we look at things from the point of view of form or even culture, *Homo sapiens* and *Homo neanderthalensis* are different species. The skull and other anatomical features of Neanderthals are still recognisable, and their culture is very different from ours.

According to Pagani, therefore, the question «How many species of humans (and their ancestors) were there?» is poorly phrased. Time and incomplete fossil records prevent us from having a precise, let alone definitive, answer. In his opinion, it would be better to ask how many there were in each «slice» of time: «All the branches that we are likely to be able to define as branches». And to count how many species there are on those branches. We would then see that around three to two

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<sup>11</sup> A good introduction to Neanderthals can be found in: WRAGG SYKES, R. *Neanderthal. Vita, arte, amore e morte*. Torino: Bollati Boringhieri, 2021 [*Neanderthal: Life, Art, Love and Death*]. Or Manzi, G. *L'ultimo Neanderthal racconta. Storie prima della storia*. Bologna: Il Mulino, 2021 [*The Last Neanderthal Tells All: Stories Before History*].

million years ago there were at least a dozen species of different genera. The disappearance of the Australopithecines reduced this number, but the migration of the first forms of *Homo* from Africa to Asia increased the number with other Asian and European species. If we «fast forward» to a more recent time, the only species left is us, *Homo sapiens*. Unlike what the ancients thought, however, we are not unique because we are better than others, or the result of an instant creative fiat. We are the last survivors of an evolutionary bush that once held a wealth of species; by luck, fate, evolution or chance, we are now alone. What caused our survival and the disappearance of our cousins or distant ancestors is still uncertain. We only know that other men and women more or less similar to us have disappeared, swallowed up in the mists of time.