

# The Puzzle of the Origin of Human Persons

**ALFRED DRIESSEN**

University of Twente (The Netherlands)  
Driessen.Alfred@gmail.com  
ORCID: 0000-0002-7901-4020

**Abstract:** The fundamental question about the origin of human persons asks for a multidisciplinary approach. Biology and genetics have made remarkable progress in the last two decades. In addition, (pre-) history, philosophy, and anthropology contribute significantly to a correct solution. Also, the Jewish-Christian tradition provides elements to the complex puzzle. The present study attempts to show that recent genetic data can be an integrated part of a coherent view of the origin of human persons.

**Keywords:** human evolution, DNA, homo sapiens, human person, Neanderthals, Adam and Eve.

## Introduction

One of the big questions we human beings try to solve is from where we come. It is a challenging endeavor as many disciplines, like history and prehistory, paleontology, modern biology, and genetics, contribute to the answer. The recent Nobel Prize awarded to Svante Pääbo demonstrates the maturity and significance of genetic research on Neanderthals and other extinct hominins. In addition, anthropology and, in general, phi-

osophy provide additional input to the puzzle. Religion offers historical or mythological writings and traditional wisdom for a better understanding of the characteristics of humans. Especially mentioned could be the first book in the Judeo-Christian tradition, Genesis, which deals with the creation of the world and the first human persons.

The author is aware of studies that dealt with the origins of human beings and simultaneously took into account modern biology and theology. One could mention (Kemp 2011), (Kemp 2020), (Kemp 2023), (Bonnette 2017), (Suarez 2016), (Tabaczek 2020), (Uhlik 2020), and especially (Schins 2022). In the present study, something new is added, emphasizing the ontological difference between an animal and a human person. The difference is not detectable by biological means alone. As one deals with a new level of intellectual and will-related abilities, philosophy and humanities are needed. The present study considers the possibility that hominins-animals and human persons simultaneously existed that biology would not distinguish. In this way, novel solutions to the puzzle of the origin of humans become feasible.

Before starting, one should specify the difference between an animal and a human person. Many aspects are in common. First, one may mention biology, including the capacity to gather data from the environment, process these data, and react accordingly. However, there is more. Roger Penrose, for example, states that the human mind can perform actions that exceed the potential of any data processor feasible in technology or biology (Penrose 1989).

Humans exceed the purely biological level with the capacity for intuition, contemplation, grasping the meaning of concepts, and producing works of art. They communicate with each other in an advanced way and form abstract concepts from the data input of the senses. These may include realities not found in the physical world, like mathematical entities and moral concepts.

## 1. Biology and the DNA

To understand more about the history of life, one traditionally searched for remains at historic and prehistoric sites. The discovery of DNA and the meanwhile routinely applied and affordable DNA testing and analysis opened a new way of studying the historical evolution (Sawchuck 2019). There is unique detailed information on the genetic code in each animal or plant cell. This code is stored in the DNA string, consisting of nano-sized molecules – called base pairs- arranged in a double helix. In humans, it involves more than 3 billion base pairs.

How enters history in this code? Consider a high-level animal. The male and female genetic information comes together at the fertilization of the egg cell. This information does not simply add up; otherwise, the new DNA string would have double length. Instead, pieces (genes) of both parents are taken alternating without extending the total string length. This process is called recombination. In addition, slight variations (mutations) occur randomly, which, in most cases, do not inhibit the further development of the new individual. The number of changes per generation is, by approximation, a constant. One can estimate how many generations have passed by counting the number of variations due to recombination and mutation. The genetic code changes establish a molecular clock (Alex and Moorjani 2017). Comparing genetic data with fossil data, one can ascertain calibration points. When taking the DNA of two individuals and counting the differences in a specific part of the DNA, one can estimate the time passed since the Most Recent Common Ancestor (MRCA). Therefore, prehistoric history research is possible by analyzing the DNA of living humans and animals.

Fortunately, also examinations of fossils provide DNA that enriches the puzzle of establishing a genetic tree or obtaining information on gene transfer in the past. One should mention Pääbo and coworkers (Green et al. 2008), (Prüfer et al. 2014), and (Kuhlwilm et al. 2016), who studied the DNA of Neanderthals living about 50 000 years ago; see also (Slimac et al. 2022). This DNA analysis does not need to compare all 3 billion base

pairs. Instead, one may select a specific part or a set of genes. By choice of this set, the MRCA may vary.

Two specific sets of genetic material are especially suitable for a reliable genetic analysis: the genetic code transmitted exclusively by the father or otherwise the mother to the children. In these cases, changes in the genetic material occur entirely by mutations. The Y-chromosome is found only in the DNA of a male and is transmitted only from father to son. On the other hand, mitochondrial DNA (mtDNA) is present in male and female offspring but is inherited exclusively from the mother. There are exceptions to this general rule for the transmission of mtDNA. However, according to (Luo et al. 2018), the biparental inheritance of mtDNA does not leave detectable marks on the human genetic record.

The first astonishing result of the DNA analysis is the complete continuity between human persons and animals. If one compares the DNA of all living human persons, one finds a variation of 0.1 % in the genes. Recent hominins, like Neanderthals, are slightly more different by 0.3% (Green et al. 2010), (Mullikan 2010). This difference is small enough to allow interbreeding with humans with fertile offspring.

The continuity observed, of course, is restricted to the biological aspects. Biology methods consider only the pure material aspects of reality. (Turbón 2020) explains: *Culture is not written into the genome*. Already with higher animals, one observes how parents teach and transmit culture to their offspring. However, the culture of animals is extremely modest compared to the culture of human persons.

With the continuity in biological evolution between human persons and extinguished hominins and apes, one could conclude that there is no difference between humans and animals, neither in the biological nor any other aspect. The human person would be just a highly evolved animal.

There is an alternative conclusion. It starts with the observation that evolution is slow. The MRCA of present-day humans and chimpanzees lived about 6–8 million years ago (difference in DNA 1.2 %). One encounters the MRCA of Neanderthals and *Homo sapiens* about half a million years ago. Evolution in this relatively brief period resulted in a difference in DNA of 0.3 %. Nearly nothing changed in the last 100 to 200 thousand

years of evolution, but there have been dramatic changes with the introduction of *Homo sapiens*. The historian Harari comments:

Seventy thousand years ago the Cognitive Revolution transformed the *Sapiens* mind, thereby turning an insignificant African ape into the ruler of the world. The improved *Sapiens* minds suddenly had access to the vast intersubjective realm, which enabled them to create gods and corporations, to build cities and empires, to invent writing and money, and eventually to split the atom and reach the moon (Harari 2016, 410).

It is not very likely that small changes in the DNA could initiate the Cognitive Revolution. Instead, looking for other causes or changes outside the strict biological realm could be more promising.

## 2. Focusing on *Homo sapiens*

It is now possible to focus further on the origin of the human person within the group of *Homo sapiens*. The most important conclusion of the previous section was the continuity and similarity that biology encounters between *Homo sapiens* persons and animals. In the following, we summarize the complex development of *Homo sapiens* and their relationship with other hominins. Green et al. (2008) determined the complete mtDNA of a 38,000-year-old Neanderthal individual. They stated: *Analysis of the assembled sequence unequivocally establishes that the Neanderthal mtDNA falls outside the variation of extant human mtDNAs.*

Extending the analysis to the complete genome of a Neanderthal from the Altai mountains, Prüfer et al. (2014) could ascertain gene flow between Neanderthal, Denisovan, and early modern humans; see also (Sankararaman et al. 2012). Kuhlwilm et al. (2016) proposed a genealogical tree indicating where and when gene flow occurred. Posth et al. (2017) focused on the mitochondrial genome and studied the relationship between humans, Neanderthals, and Denisovans. Similarly, Sharbrough et al. (2017) studied the mtDNA of hominins and the gene flow from hominins to modern humans. They tried to explain that *unlike in the nuclear genome, there has not been any detectable mtDNA introgression from Nean-*

*derthals or Denisovans into modern human populations.* Chan et al. (2019) studied the mtDNA of present-day humans focusing on Southern Africa. They conclude that human origins can be found in a paleo wetland in Southern Africa about 200.000 years ago. It took about 70.000 years before leaving the homeland.

The previously mentioned work centered chiefly on mitochondrial DNA. Petr. et al. (2020) presented sequences of the first Denisovan Y chromosomes and the Y chromosomes of late Neanderthals. Like (Kuhlwilm et al. 2016), they propose a schematic genealogical tree. One can summarize their results:

- The common antecessors of modern humans, Neanderthals, and Denisovans, experienced a population split into two branches: modern humans and Denisovans/Neanderthals about 600.000 years ago.
- About 200.000 years later, the Denisovans/Neanderthals branch separated into two independent groups.
- The Neanderthal branch splits into three subdivisions, as verified by examining the remains at three different sites in Europe and Asia. Similarly, modern humans diverged from a single African branch and became present all over Africa, Asia, Oceania, and Europe.
- The comparison of genes gives evidence of gene flow from Neanderthal hominins to *Homo sapiens* in Europe and Asia. Genes from Denisovans one encounters in humans of Asia and Oceania. No gene flow from modern humans to hominins seems to occur in the same period (about 100.000 to 40.000 years ago).
- At about 35.000 years ago, all hominins have become extinct. Modern humans, however, increased in number and could extend to all continents.

Examining the gene flow between modern humans and archaic hominins (Neanderthals and Denisovans), the gene flow between Neanderthal and *Homo sapiens* remarkably is unidirectional. There is no DNA of modern *Homo sapiens* in the genes of Neanderthals. One exception is the gene flow from an extinguished early modern human to an Altai Neanderthal, at least 200.000 years ago. Kuhlwiilm et al. (2016) comment:

Genetic evidence of gene flow from modern humans into Neanderthals or Denisovans, however, remains elusive.

Since 1987 scientists have studied the mtDNA of increasingly larger groups of humans from all regions (Cann, Stoneking and Wilson 1987). Later studies confirmed the conclusion of the first study. All persons now living have descended from a single female Homo sapiens. This female individual lived 200.000 years ago with an uncertainty of 40.000 years (Chan et al. 2019). In literature, this female Homo sapiens at the bottleneck in the genetic tree for the matrilineal line is sometimes called mitochondrial Eve, mtEve. According to (Sharbrough et al. 2017) there are no traces of gene flow from Neanderthals or Denisovans. As there is a genetic bottleneck, theories about the multiregional origin of humans become less probable.

Regarding the Y-chromosomes of now-living persons, the work of (Petr et al. 2020) confirms the pronounced difference between the divergent African lineage A00 and the non-African population. The MRCA, living about 250.000 years ago, is older than that obtained with the mtDNA line.

Above, we mentioned the gene flow asymmetry between late modern humans and modern Neanderthal and Denisovan. Now gender asymmetry appears in the gene flow. The result of this gene flow is only detectable in the nuclear DNA. In the mtDNA, however, of present-day humans, no traces of Neanderthals or other hominins younger than mtEve are visible (Chan et al. 2019). One may therefore conclude that only the offspring of a male Neanderthal (or male Neanderthal/Homo sapiens hybrid) and female modern human lead to contributions to the gene pool of presently living humans.

In summary, research dealing with mtDNA indicates a genetic bottleneck of a single female Homo sapiens. All now living persons are related to her in a direct line. Focusing on the mtDNA, one observes no evidence of intermixing with other hominins like Neanderthal or Denisovans. One encounters a significantly older MRCA when conducting a similar investigation for the Y-chromosome DNA. In addition, there is evi-

dence of gene transfer from Neanderthals and Denisovans to present-day Homo sapiens.

### **3. When did the first human person arise?**

One could start with some basic assumptions. First of all, now living Homo sapiens are human persons. The most natural way of arriving at this present-day situation could be the second assumption: the offspring of a human person is also a human person. There could be a discussion about whether both parents of a human person are necessarily also human persons. Being a human person exceeds biology and the genetic code inherited by the parents. Unlike biological procreation, an offspring of a union where only one of the parents is a person could also be a person.

Another assumption is of great importance. Human persons are aware that they are different from other animals, even if these animals biologically are very close to their bodily constitution. Nowadays, we cannot imagine this situation. There is a clear difference between human persons and animals. However, this awareness of being different would also be present if the nearest animals were members of the same group of hominins.

Being a person with an extended intellectual and will-related capacity enables a shortcut to evolution. By reflecting, planning, and imagination, a person can decide whether a specific approach is suitable to solve a problem. Explaining the new approach or procedure is sufficient to transmit this new knowledge. Later the teaching may be formalized, resulting in efficient teaching institutions. In this way, humans have an enormous advantage in surviving external and internal challenges like climate change or illness.

Could human persons have arisen as a completely new species independent of all biological antecessors or neighbors? Kemp (2020) discusses this question in detail within the framework of catholic evolutionism. The genetic origin of human persons could result from an extraordinary divine intervention. Against such a view, one could quote John Henry Newman (1863).



It is as strange that monkeys should be so like men, with no historical connection between them, as that there should be no course of facts by which fossil bones got into rocks.

Above, we assumed that all currently living humans are persons. Safely one could also include the humans in the old civilizations like Mesopotamia and Egypt. The above-given quotation of Harari suggests that the *Homo sapiens* hominins, initiating the cognitive revolution, were also human persons. Archaic hominins, originating about 500.000 years ago, were probably no persons, even if they showed advanced intellectual capacity and use of tools and fire (Bae 2013). The most recent hominins, the Neanderthals and Denisovans, disappeared about 35.000 years ago. They had intercourse with human ancestors (persons), as seen in the DNA of all present-day European humans.

There is a controversy about whether Neanderthals were humans. Hoffmann et al. carried out uranium-thorium dating of several artworks in Iberian caves. Their results indicated that this artwork must be older than 64.000 years (Hoffmann et al. 2018). Accordingly, they conclude that Neanderthals possessed a much richer symbolic behavior than previously assumed. A year later, White et al. (2019) published a study where they put severe doubts about the validity of the uranium-thorium dating of (Hoffmann et al. 2018); see also (Ochoa, Garcia-Diez, Domingo and Martins 2020). There is no evidence that Neanderthals, and even less their ancestors, have the capacities observed in modern *Homo sapiens* persons.

One should now accept indirect evidence to narrow the time window for the origin of human persons. The female line has a unique genetic bottleneck, as observed by mtDNA. Was mtEve a person? If our basic assumption is valid about a person's offspring being a person, then she is a good candidate. All present-day individuals connect by this bottleneck to the previous generations. What is unique with the first individual at this bottleneck?

Intuitively something new is expected; otherwise, the unique position would be surprising. Biologically nothing new has evolved, as the intercourse of the offspring of mtEve with hominins, including *Homo sa-*

piens animals, Neanderthals, and Denisovans, remained possible. However, a non-biological event could have been possible: mtEve became the first female human person. She and all her offspring received human beings' peculiar intellectual capacity and long-term willpower. In this way, Homo sapiens could generate a cognitive revolution (Harari 2016).

What do we know about the male analog of mtEve, Y-Adam? A genetic bottleneck coinciding in time with mtEve is not probable. Ayala (1995) demonstrated that a variation in the genetic material is found in the nuclear DNA of human persons. Four different variants are transmitted, one for one, to the next generation. That means that at any time, at least four individual couples are involved and, considering realistic statistics, hundreds. For a discussion of the findings of Ayala in recent literature, see (Bonnette 2017).

If mtEve, a human person, is in direct line mother of all present-day humans, then it is apparent that she had intercourse with a male Homo sapiens. We observed that Y-Adam is probably thousands of years older than mtEve. The mate of mtEve, however, appears to fulfill a nontrivial role. For convenience, one may call him Adam. Assuming mtEve is a human person, one could also suppose that the father of her offspring was a human person. Her longstanding mate, her husband, is the father of all her children and, consequently, an ancestor of all living persons. However, if we consider the male ancestors – equal in age with mtEve or younger, of present-day persons – for sure Adam can be listed, but also Homo sapiens animals and, in the case of Europeans, Neanderthals.

In the genetic code of present-day humans, we see gene transfer from Neanderthals and other hominins. As this transfer is only visible in the nuclear DNA but not in the mitochondria, it originates in intercourse between hominins with the female descendants of mtEve. No hominins are in the direct line of the female antecessors from mother to daughter. The hominins enter only via alternative lines in the genetic family tree. Each time such an event happened, the MRCA of the now-living humans shifted back in time. As a result, Y-Adam is less defined and also older than mtEve.

The asymmetry in intercourse behavior sheds light on another astonishing issue. It is a fact that there is no gene transfer from modern Homo

sapiens (human persons) to recent Neanderthals. It seems that humans and Neanderthals recognized the difference between a pure Neanderthal and a human person individual.

Assuming that mtEve and her husband were the first human persons ever, one could work out scenarios about the following steps. The children of the first marriage had either intercourse with each other or would form couples where one of the parents would be a Homo sapiens animal. In both cases, the children of this union would be human persons. Have these unions between human persons and Homo sapiens animals had a stable, longstanding character? Probably not, as these were no marriages but accidentally occurring acts like rape or bestiality. Once again, one should mention the gender asymmetry. If females of Homo sapiens animals were involved in the generation of human persons, then mtEve would not be the MRCA.

The colony of Homo sapiens seemed to live isolated for tens of thousands of years. According to (Petr et al. 2020), the isolation resulted from a locally favorable climate and geological circumstances in an otherwise adversary environment. About 70 thousand years later, geology changed, and corridors appeared that allowed the spreading of the Homo sapiens persons to southern parts of Africa and north of Africa to Eurasia.

Homo sapiens encountered other groups of hominins first in Africa (Ragsdale et al. 2023) and later in Europe (Slimac et al. 2022) and Asia. They intermixed but only with gender asymmetry.

By spreading from favorable climate regions to unknown and varying environments, Homo sapiens and hominins like Neanderthal and Denisovan faced severe challenges. Climate and geographical issues made survival difficult. In addition, new classes of animals, new diseases, and the lack of appropriate food during long and cold winter seasons put severe challenges. Remarkably, only Homo sapiens survived and emigrated in prehistoric times beyond many substantial barriers, like rivers, mountains, deserts, and branches of the open sea.

If one looks back less than 30.000 years, other hominins have become extinct. Homo sapiens persons showed evidence of settling and surviving on all continents. In all places, they relinquished signs of artistic activity.

#### 4. Discussion

What would be the position of theology in this highly speculative approach? Ratzinger (1964) already dealt with the question of the origin of man. He considered a possibility that largely agrees with our approach. As quoted in (Sanz 2018), he introduced a challenging hypothesis:

The process of becoming a human person lies in its inner depth outside of the biologically measurable. That means: One may assume a highly probable result that hominization in the biological stock originated from polygenism. Even then, the possibility remains that the ingenious lightning (Blitz) to think transcendence – happened for the first time in one or two individuals. Biological polygenism and theological monogenism are not necessarily mutually exclusive opposites because their level of questioning does not entirely coincide.

Ratzinger distinguishes between scientific (biological) and theological monogenism. In his view, theological monogenism does not necessarily imply biological monogenism.

Biological and theological monogenism differ because biology requires a specific number of procreators. Two individuals of the same biological species are needed to generate offspring. Theologically the demand may be less severe: one individual alone – a human person – is sufficient to generate offspring that is a person. The other individual should be biologically related but could be a person or animal. There is no evidence of biological monogenism. However, human persons are directly associated with a single female, mtEve. If one assumes that she had a stable relationship (marriage) with a single male person, then all human persons are also directly related to her husband: theological monogenism.

The puzzle of the origin of humanity mentioned in the introduction still needs to be fully completed. New data could alter the argumentation or even falsify significant aspects. The author hopes that this work will stimulate further studies that integrate the results of modern science with a type of anthropology exceeding the pure biological dimension of the human person.

## Acknowledgments

The author acknowledges the innovative approach of Juleon Schins to the puzzle of human origin. The discussions with him and Antoine Suarez helped develop a coherent vision.

## References

- Alex, Bridget, and Moorjani, Priya. 2017 “DNA dating: How molecular clocks are refining human evolution’s timeline.” *The Conversation*, April 7. <https://theconversation.com/dna-dating-how-molecular-clocks-are-refining-human-evolutions-timeline-65606>.
- Ayala, Francisco J. 1995. “The Myth of Eve: Molecular Biology and Human Origins.” *Science*, 270: 1930–1936.
- Bae, Christopher J. 2013. “Archaic Homo Sapiens.” *Nature Education Knowledge* 4 (8): 4.
- Bonnette, Dennis. 2017. “The Impenetrable Mystery of a Literal Adam and Eve.” *Nova et Vetera*, English Edition 15 (4): 1013–1036.
- Cann, Rebecca L., Stoneking, Mark, and Wilson, Allan C. 1987. “Mitochondrial DNA and human evolution.” *Nature* 325: 31–36. DOI: <https://doi.org/10.1038/325031a0>.
- Chan, Eva K. F. et al. (12 authors) 2019. “Human origins in a southern African palaeo-wetland and first migrations.” *Nature* 575: 185–189.
- Green, Richard E. et al. (25 authors) 2008. “A complete Neanderthal mitochondrial genome sequence determined by high-throughput sequencing.” *Cell* 134 (3): 416–426. DOI: <https://doi.org/10.1016/j.cell.2008.06.021>.
- Green, Richard E. et al. (56 authors) 2010. “A Draft Sequence of the Neanderthal Genome.” *Science* 328 (5979): 710–722. DOI: <https://doi.org/10.1126/science.1188021>.
- Harari, Yuval Noah. 2016. *Homo Deus, A Brief History of Tomorrow*. Penguin Random House, UK.
- Hoffmann, Dirk L. et al. (13 authors) 2018. “U-Th dating of carbonate crusts reveals Neanderthal origin of Iberian cave art.” *Science* 359 (6378): 912–915. DOI: <https://doi.org/10.1126/science.aap7778>.
- Kemp, Kenneth, W. 2011. “Science, Theology, and Monogenesis.” *American Catholic Philosophical Quarterly* 85 (2): 217–236.

- Kemp, Kenneth, W. 2020. "God, Evolution, and the Body of Adam." *Scientia et Fides* 8 (2): 139–172. DOI: <https://doi.org/10.12775/SetF.2020.017>.
- Kemp, Kenneth, W. 2023. "Humani Generis & Evolution: A Report from the Archives." *Scientia et Fides* 11 (1): 9–27. DOI: <https://doi.org/10.12775/SetF.2023.001>.
- Kuhlwilms, Martin et al. (22 authors) 2016. "Ancient gene flow from early modern humans into Eastern Neanderthals." *Nature* 530 (7591): 429–433.
- Luo, Shiyu et al. (17 authors) 2018. "Biparental Inheritance of Mitochondrial DNA in humans." *PNAS*, 115(151):13039–13044. DOI: <https://doi.org/10.1073/pnas.1810946115>.
- Mullikan, Jim. 2010. "Complete Neanderthal Genome Sequenced." Interview NIH News, <https://www.genome.gov/27539119/2010-release-complete-neanderthal-genome-sequenced>.
- Newman, Henry, John. 1863, quoted in (Kemp 2020, 144).
- Ochoa, Blanca, García-Diez, Marcos, Domingo Inés, and Martins, Andrea. 2020. "Dating Iberian prehistoric rock art: Methods, sampling, data, limits and interpretations." *Quaternary International* 572: 88–105. DOI: <https://doi.org/10.1016/j.quaint.2020.08.048>.
- Penrose, Roger 1989. *The Emperor's New Mind*. Oxford: Oxford University Press.
- Petr, Martin, et al. (18 authors). 2020. "The Evolutionary History of Neanderthal and Denisovan Y Chromosomes." *Science* 369 (6511): 1653–1656.
- Posth, Cosimo, et al. (11 authors). 2017. "Deeply divergent archaic mitochondrial genome provides lower time boundary for African gene flow into Neanderthals." *Nature Communications* 8(16046), DOI: <https://doi.org/10.1038/ncomms16046>.
- Prüfer, Kay et al. (45 authors). 2014. "The complete genome sequence of Neanderthal from the Altai Mountains." *Nature* 505:43–50.
- Ragsdale, Aaron P. et al. (7 authors). 2023. "A Weakly Structured Stem for Human Origins in Africa." *Nature* 617: 755–763.
- Ratzinger, Joseph. 1964. *lecture notes*, quoted in (Sanz 2018).
- Sankararaman, Sriram, Patterson, Nick, Li, Heng, Pääbo, Svante and Reich, David. 2012. "The Date of Interbreeding between Neandertals and Modern Humans." *PLoS Genetics* 8 (10), e1002947. DOI: <https://doi.org/10.1371/journal.pgen.1002947>.
- Sanz Sánchez, Santiago. 2018. "Joseph Ratzinger e il peccato originale : riflessioni a proposito di un libro mancato." *Revista Española de Teología* 78: 439–457.
- Sawchuck, Elizabeth, and Prendergast, Mary. 2019. "Ancient DNA is a powerful tool for studying the past – when archeologists and geneticists work together."

- er.” *The Conversation*, March 11, <https://theconversation.com/ancient-dna-is-a-powerful-tool-for-studying-the-past-when-archaeologists-and-geneticists-work-together-111127>.
- Schins, Juleon. 2022. *Eve the Mother of All Living: Science and Theology of the Human Body*. Westwood Books Publishing.
- Sharbrough, Joel, Harvid, Justin C., Noe, Gregory R., Warren, Jessica M., and Sloan, Daniel B. 2017. “The Mitonuclear Dimension of Neanderthal and Denisovan Ancestry in Modern Human Genomes.” *Genome Biol. Evol.* 9 (6): 1567–1581.
- Slimac, Ludovic, et al. (23 authors). 2022. “Modern human incursion into Neanderthal territories 54,000 years ago at Mandrin, France.” *Sci. Adv.* 8 (6). DOI: <https://doi.org/10.1126/sciadv.abj9496>.
- Suarez, Antoine. 2016. “Transmission at generation: Could original sin have happened at the time when Homo sapiens already had a large population size?” *Scientia et Fides* 4 (1): 253–294. DOI: <http://dx.doi.org/10.12775/SetF.2016.014>.
- Tabaczek, Mariusz, OP. 2020. “Special Issue of Scientia et Fides on Evolution – Introduction [Philosophical and Theological Aspects of Evolution].” *Scientia et Fides* 8 (2): 7–12.
- Turbón, Daniel. 2020. “The distinctive character of human being in evolution.” *Scientia et Fides* 8 (2): 65–93. DOI: <https://doi.org/10.12775/SetF.2020.015>.
- Uhlik, Marcin Edward. 2020. “Could there have been Human Families where Parents Came from Different Populations: Denisovans, Neanderthals or Sapiens?” *Scientia et Fides* 8 (2): 193–221. DOI: <https://doi.org/10.12775/SetF.2020.019>.
- White, Randall, et al. (44 authors). 2020. “Still no archeological evidence that Neanderthals created Iberian cave art.” *Journal of Human Evolution* 144 (102640). DOI: <https://doi.org/10.1016/j.jhevol.2019.102640>.