Creation of Cultural Routes

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Experiences from the Danube's Archaeological eLandscapes Project

Interreg
Danube Transnational Programme
Danube's Archaeological eLandscapes

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Neandertals — First Masters of Europe

Ivor Janković
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At the site of the original discovery
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WHO ARE THE NEANDERTALS? What is their role in our own evolution? Are they just extinct relatives that once roamed the Eurasian landscape that, once the first members of our own subspecies, *Homo sapiens sapiens* spread out of the African homeland, disappeared without a trace? These (and many other) questions about Neandertals have been hotly debated ever since the discovery of the first recognized Neandertal in a small cave in Germany's Neander Valley in 1856. Since then, their physical remains (i.e fossils), as well as abundant traces of their daily activities (tools, remains of animals they hunted, and other traces of their presence at archaeological sites) have been discovered throughout Europe and parts of Asia. Indeed, the archaeological and biological data on Neandertals are more abundant than for any other prehistoric human group before the emergence of anatomically modern humans, offering us a solid basis for study of their biology and culture. In recent times, the rising field of paleogenomics entered the story — and changed the way we think about these ancient humans forever. So what can we say about them, after more than 160 years of scientific study?

The story of Neandertals begins in August 1856, when workers came across strange looking human bones while removing cave sediment from the Small Feldhofer Cave in the Neander Valley near Düsseldorf, Germany. It was just before the publication of Charles Darwin's famous work *On the Origin of Species* (1859), and soon evolution became one of the main topics, not only among scientists, but also among the general public. For this reason, the discovery of the bones in Neander Valley caused great interest. For those who opposed Darwin's theory, they interpreted the unusual anatomy as the result of disease or unusual adaptations of recent humans. On the other hand, supporters of evolutionary thought used that finding as a basis of the thesis that humans had gone through evolutionary changes in the past.

Be that as it may, the scientific name *Homo neanderthalensis*, which some experts still use today, was officially proposed by William King in 1864, and since then it has become an indispensable synonym for almost all the ancient inhabitants of Europe, often in a negative context. It is hard to find someone who has not said 'Neandertal' at least once, whether it was in scientifically based discussions or in a conversation about the behaviour of some sports fan groups. However, even the negative publicity resulted in the fact that Neandertals, at least as a term, needs no introduction. But our knowledge of Neandertals shows them to be far more than a derogatory stereotype. This is because, fortunately, the Neandertals left behind many traces. From archaeological finds and sites where they stayed for a longer or shorter time and carried out many daily activities there (leaving traces of their culture, such as stone tools, the remains of hunting animals or hearths), up to the anthropological findings of their bones themselves. Our insight into the Neandertals has been enriched in recent times by the results of ancient DNA analysis (DNA isolated directly from the bones of Neandertals, and more recently from the sediments at their sites).

Fortunately for science, soon after the discovery in the Neander Valley, a series of new finds that we now attribute to Neandertals came from sites all over Europe (and parts of Western and Central Asia). As soon as the early twentieth century, Neandertal bones were discovered in a large number of European sites, some discovered before (but not recognized until after) the Neander Valley specimen: Belgium (Engis Cave, 1829/30), Gibraltar (Forbes Quarry, 1848), Germany (Kleine Feldhofer Grotte, 1856, Taubach, 1887, Ehringsdorf, 1908), Belgium (La Naulette, 1866, Spy, 1886), Czech Republic (Šipka, 1880, Ochoz, 1905), Spain (Bañolas, 1887), Croatia (Hušnjakovo Hill in Krapina, 1899), and France (La-Chapelle-aux-Saints, 1908, Le Moustier, 1908, La Quina, 1908 and La Ferrassie, 1908). These discoveries laid the foundation for the scientific study of Neandertals already in the early period of the development of a new scientific discipline — paleoanthropology. Of course, research continues, and it is estimated that today we have the remains of the bones of around 500 different Neandertals of both sexes and of different ages, from different geographical areas and over a longer period of time (sometimes consisting of almost complete skeletons, and sometimes these are isolated bones or pieces of bones). This allows us a qualitative insight into many aspects of their evolutionary development, adaptations, physical and cultural characteristics and differences, and so on. The remains of Neandertals have been found in almost all parts of Europe (Belgium, Gibraltar, Germany, the Czech Republic, Spain, Croatia, France, Slovakia, Hungary, Italy, Poland, Greece, Bulgaria, Serbia, Ukraine, Russia), and further to West and Central Asia (Iraq, Iran, Israel, Syria, Uzbekistan and Russia). If we add archaeological sites where the remains of their material culture were found, the number of sites increases drastically.

All this allows us to present a great deal of knowledge about them. However, caution is required, since, just as there is no 'typical' representative of anatomically modern humans (*Homo sapiens sapiens*) — because we are all part of a polytypic species whose members differ in their individual, as well as some common characteristics of populations in certain areas, the same can be said of all past human groups. There never was a 'typical Neandertal' who could represent all the diversity of characteristics seen in Neandertals over space and time. But it is possible to talk about a number of features (especially anatomical details) that are much more common in Neandertals than in earlier human groups, or in the so-called anatomically modern humans. If you were to put a 'typical' Neandertal and a 'typical' modern European side by side (which is certainly partly wrong, since most of the physical characteristics of modern Europeans actually represent adaptations that occurred in Africa, where our ancient ancestors came from), it is possible to see certain differences.

Lateral view of
a Neandertal skull
from La Ferrassie
© IVOR JANKOVIĆ

The Neandertal skull is relatively low and elongated, with low but robust regions above the eyes that are adorned with the so-called supraorbital arches or torus. The entire middle part of the face is very prominent, and the nasal cavity is large. The back of the skull has a protrusion on the occipital bone, and if we look at the skull of a Neandertal from the back, we will see that it is oval in shape (in contrast to the slightly narrower skull of anatomically modern humans, which has a more pentagonal shape). The skull itself is of large dimensions, although the size of the brain does not differ much from that of early modern humans. Other often mentioned characteristics of Neandertals are visible in the lower jaw and teeth. Most Neandertal mandibles have no chin (although some of the later Neandertal specimens do have the beginnings of this feature). Furthermore, Neandertals, unlike most of us, had no problem with the sometimes painful process during the growth of their wisdom teeth (in contemporary humans, this often results in a need for medical treatment). Between the vertical part of the jaw and the wisdom tooth on most Neandertal mandibles, there is enough space that the process of dental growth passed without major problems. Furthermore, there are certain details in the anatomy of the molars (they often have an enlarged pulp chamber resulting in fusion of the roots — a condition called taurodontism, as well as some other differences in the features of the crown of the teeth), all teeth are large, and the incisors of the upper jaw are often shovel-shaped.

Apart from those seen in the skull and lower jaw, there are also differences in anatomical details of the postcranial skeleton. Perhaps the most evident is the overall robustness of the Neandertal built. The results of various analyses show that Neandertals were about twice as strong as contemporary humans (we base this on very pronounced muscle attachments and thickness of the cortical bone). Furthermore, strong muscle grips and strong bones speak of the importance of physical activities in the Neandertal lifestyle. Neandertals were very active and often moved, carrying all their necessities with them while hunting prey. Their hunting strategy also required a high energy investment and close (sometimes very dangerous) encounters with prey. Unlike modern human groups of the Upper Paleolithic, archaeological findings tell us that Neandertals usually did not hunt from distance (they did not have projectile launchers or bows and arrows), but used heavy and massive spears that could be thrown from close range, or used for stabbing. Many injuries visible on their bones can be explained as a result of hunting accidents. For the above reasons, increased energy consumption required a rich protein diet — analyses of archaeological and zooarchaeological findings, as well as analyses of stable isotopes, show that the Neandertals based their diet heavily on meat (this does not mean that they did not also consume some plants). In fact Neandertal diets differ depending on geographic and ecological factors. Meat was always important but some Mediterranean Neandertals consumed a good deal of fish, birds and other sea resources. Also temperately-adapted Neandertals ate more plants that did their cold steppe-adapted cousins.

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Only some, perhaps the most noticeable, features of Neandertal anatomy are listed here. However, it is evident that there are differences in anatomical details between Neandertals and anatomically modern humans. But modern science does not strive (and must not strive) simply to enumerate differences in the details of anatomy (or behaviour). Based on the sheer number of anatomical differences between the skull and skeleton of Neandertals and modern humans, it is incorrect to claim that Neandertals are a separate species. Before such details are used for taxonomic purposes, it is necessary to explain why these differences exist. If we approach this in this way, then it soon becomes apparent that a large part of these details are actually the evolutionary heritage from earlier human groups, from which the Neandertals evolved. Furthermore, a part of the features are the result of adaptations related to lifestyle or climatic conditions. Finally, archaeological and genetic data tell us that there were always relatively few Neandertals, which caused certain features to become more frequent and prevalent than would be the case in larger communities. Examples of this can also be found in modern human groups, and they are the result of relative isolation (think of populations with a high percentage of red hair or some other characteristics).

As can be read in the earlier text, Neandertal bones were found in a large number of European, as well as Asian sites. But even though the fund of fossil remains of the Neandertals themselves is relatively numerous (especially compared to earlier humans), there is an even greater number of localities that tell us about their life and behaviour on these sites based on cultural remains. The remains of the material culture that, at least in Europe, is associated with Neandertals, is called Mousterian, after the site of Le Moustier in France. Mousterian is characterized by a much larger number of standardized types of stone tools (according to the French scientist F. Bordes, there are 64 basic types), and the production itself is much more complex than in earlier cultures. The most common type consists of the so-called scrapers — tools that could be used for various activities, from scraping leather, to woodworking, cutting, etc. On some sites, although rarer, finds made of wood (spears) and of bone or horn were also found.

Since Neandertals are distinguished primarily on the basis of their characteristic anatomical details, in order to get closer to the answer when they first appear on the evolutionary scene, it is necessary to study the fossil finds of their predecessors, especially those from the Middle and Early Upper Pleistocene. It is within these pre-Neandertal European groups that we can observe a series of changes in anatomy and an increase in 'Neandertal' features over time. Thus, the appearance of some characteristics that later become typical for Neandertals is already visible in finds dated between 500,000 and 300,000 years before the present, such as Vértesszöllös in Hungary, Petralona in Greece, Arago in France, Steinheim in Germany, Swanscombe in England and Sima de Los Huesos in Spain.

Skull of
a Neandertal Child,
Teshik Tash
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At somewhat younger sites, such as Ehringsdorf in Germany (about 250,000 years before the present), Biache-Saint-Vaast in France (190–160,000 BP), Apidima 2 in Greece (about 160,000 BP), these features become more numerous, to the extent that some experts already count them among the earliest examples of Neandertals. In any case, from about 200,000 years before the present, until the appearance of the first anatomically modern humans during the Upper Paleolithic, Neandertals are the only humans on the European scene. Truly the First Masters of Europe! But although they can rightly be called the first real European phenomenon (in the sense that they evolved there), part of the Neandertal groups at some point, for reasons known only to them, spread outside their home area — first to West Asia, and later to parts of Central Asia. However, unlike in Europe, Neandertals were not the only humans there. Findings and sites like those in the Levant show that they shared that area with the first anatomically modern arrivals from Africa. It is even more interesting to point out that archaeological analyses do not show significant differences in the behaviour of those two populations. Among the most famous Neandertal sites in Asia are the Amud, Kebara and Tabūn caves in Israel, Dederiyeh in Syria, Shanidar in Iraq, Bitsun in Iran. Until recently, it was thought that the findings from the Teshik Tash cave in Uzbekistan represented the easternmost limit of the Neandertal area, but recent research (primarily based on the results of ancient DNA analysis) testifies that some Neandertal groups even spread to the Altai Mountains in Siberia (Denisova and Okladnikov caves), and met some other indigenous populations there (for now, most scientists call them by their popular, not scientific name — Denisovans).

Neandertals, during more than a hundred thousand years of their European reign (and, as we mentioned, a part of Asia), went through many trials. Climatic changes and oscillations (as well as the geographical distribution of Neandertals) during the different phases of the Pleistocene meant that some Neandertals lived in a drastically different environment and ecosystem than other groups. Some lived during periods of warm climate, which allowed them to spread to areas that were covered by the ice sheet during colder periods. On the contrary, during periods of cold climate, the expansion of glaciers caused the sea level to fall (it is estimated that the sea level sometimes varied by more than a hundred meters), and the Neandertals used areas that are hidden from our view today. That this is so is evidenced by findings such as the discovery of a Neandertal skull from the undersea of the North Sea near the Dutch coast, as well as the recently investigated site of Kaštel Štafilić–Resnik in Croatia, where stone tools made by Neandertals were found. Who knows how many more interesting discoveries await future underwater archaeologists and speleologists! But all this tells us the very important fact that when thinking about Neandertals (as well as other human groups during the long period of human evolution), it is necessary to think about many other factors that influenced them.

Reconstruction of
a young Neanderthal
© KRAPINA NEANDERTHAL MUSEUM

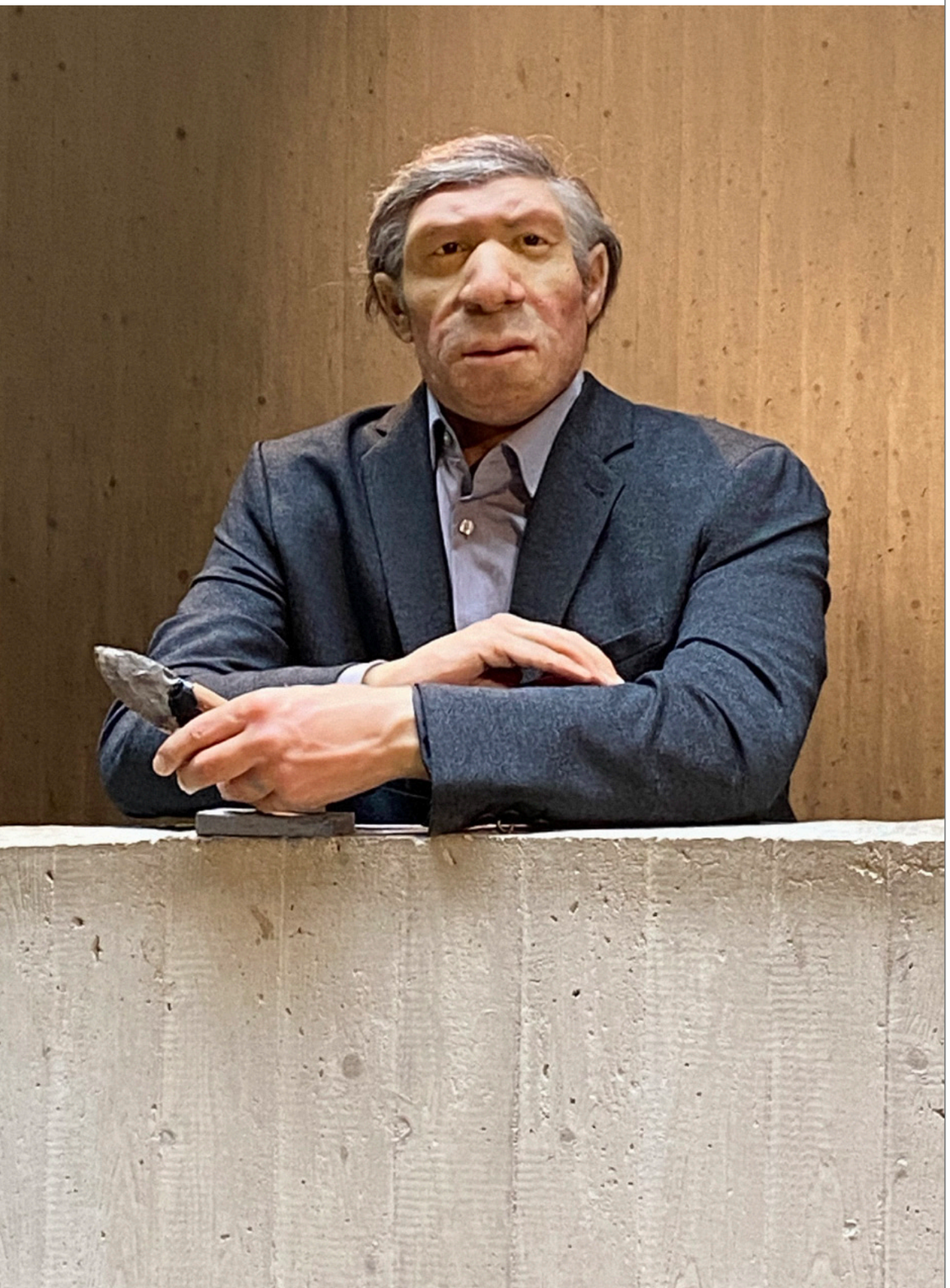
One of the main questions that scientists ask is when (and for what reasons) did the Neandertals disappear? If we base the disappearance of the Neandertals on the disappearance of their characteristic appearance and anatomy, then it is possible to confirm that they disappeared in the period between approximately 42,000 and 35,000 years before the present. This is also the period when groups of Upper Paleolithic hunter-gatherers, people who did not differ much from us in appearance, came to Europe for the first time. It is very likely that there were numerous encounters between these two prehistoric populations, which raises many interesting questions about the nature of these contacts. For this reason, it is crucial to have a precise insight into the time frames of the sites of late Neandertals and early anatomically modern humans. Unfortunately, despite the great progress in the field of radiometric dating, we still do not have enough precise data that could reliably resolve the question of the duration of coexistence of Neandertals and anatomically modern humans in Europe.

Based on recent analyses, the last Neandertals lived at several European sites, dated to about 40,000 years before present, including Vindija Cave in Croatia, Zafaraya and Las Palomas Caves in Spain, Grunta de Oliviera in Portugal, La Roche à Pierrot (Saint-Césaire) and Grotte du Renne (Arcy-sur-Cure) in France and the Belgian localities of Spy, Engis and Fonds-du-Forêt. It is interesting that many of the fossil finds mentioned above, although they undoubtedly belong to Neandertals, have some features that slightly distinguish them from earlier, classic members of that group. This is particularly visible in the gracility and some other details of the skull and skeleton (for example, in the finds from the caves of Vindija in Croatia and Saint-Césaire in France). It is also interesting to mention that at least some of these 'late' Neandertals seem to start behaving differently than their predecessors. Namely, within the Neandertal burial from the cave of La Roche à Pierrot (Saint-Césaire), various decorative items characteristic of the Upper Paleolithic were found. Similar objects were also found at the site of Grotte du Renne (Arcy-sur-Cure). Furthermore, in Italy, Poland, the Czech Republic (especially Moravia), Slovakia and Hungary there are so-called transitional cultures with characteristics of the Middle and Upper Paleolithic, which may testify to contacts and exchanges of information between Neandertals and early modern humans.

Vindija Cave
© SANJIN MIHELIĆ

As we saw at the beginning of our story about Neandertals, discussions about their role in the genealogy of modern humans has been the subject of interest of scientists and the wider public since the very discovery at the eponymous site in 1856. Despite the large amount of finds and sites, the arguments of two opposing scientific camps (one who considered the Neandertals, at least partially, our ancestors, and those who rejected any role for them in the genesis of later Europeans and considered them an extinct species) were mainly based on archaeological and anthropological evidence, and with some luck were supported by the results of radiometric dating. The taxonomic and phylogenetic status of Neandertals (whether they are a separate species, *Homo neanderthalensis*, or a subspecies of our species — *Homo sapiens neanderthalensis*) still remained the subject of sometimes rather heated debates and disagreements. During the more than one hundred and sixty-year tradition of the development of the paleoanthropological science, many explanations and models have been proposed related to the question of the origin and appearance of our species, as well as the fate of Neandertals (as well as other human groups in the past). Most of them can be reduced to three basic (most famous) theoretical models, better known by the names: Out of Africa, Multiregional model of evolution, and the Assimilation model. According to the Out-of-Africa model, the earliest development of anatomically modern humans takes place in Africa, where most of the anatomical features of modern humans appear in the period between 200,000 and 150,000 years before the present. According to this model, about a hundred thousand years ago a part of these anatomically modern groups left Africa, and went first to the Near East, and later to other areas (they started coming to Europe about forty thousand years ago). What is important to emphasize is that scientists who adhere to this model believe that these new, anatomically modern newcomers completely replaced the natives — including the local Neandertals. According to the classic version of this model, Neandertals are an extinct branch and have nothing to do with us.

The Multiregional Model is the exact opposite of the first. This model considers that since the first human groups left their African homeland (and by that we mean the humans most often referred to as *Homo erectus*, almost two million years ago, not anatomically modern humans), there has been sufficient contact between populations from different regions which caused local populations to evolve in the same direction, i.e. in the direction of anatomical modernity (with, of course, certain local characteristics). According to this model, Neandertals are only a part of a wider group of humanity and not a separate species.



The third—the Assimilation—model agrees with the Out-of-Africa model that the earliest signs of anatomical modernity can be found on that continent, so the basis of our evolutionary substrate is Africa. But it disagrees about what happened after those first anatomically modern humans left their ancestral homeland. According to the Assimilation Model, these anatomically modern newcomers at least partially mix with the natives. Since the indigenous populations were smaller, and groups of anatomically modern people continue to arrive, the indigenous people are actually being assimilated into the modern gene pool by mixing with them. In this model, Neandertals (and other groups in other geographical areas) never actually disappear — and become a part of us.

Starting in 1997, when the mitochondrial DNA sequence was successfully isolated for the first time from the original Neandertal specimen from the Neander Valley (mitochondrial DNA is transmitted through the maternal line, is present in large quantities, and has a faster rate of mutation), it seemed that the genetic research supported the Out-of-Africa model and that Neandertals died out without any contribution to later human groups. Although some scientists pointed out that due to transmission through the maternal line it is not possible to provide a sufficiently precise insight into past events and possible mixing, over the next ten years increasingly more people accepted this explanation — the Neandertals themselves are an extinct branch on the tree of human evolution. But in 2010, a real shock followed! Then, for the first time, a complete Neandertal genome was successfully isolated on several Neandertal bones from the Croatian site of Vindija Cave. The results showed that there is between 1 and 4% Neandertal genetic heritage in modern Eurasian populations (living people). That research caused a veritable avalanche of new analyses of fossil finds, as well as great progress in the development of analysis methodology, speed and precision. Today, we have several genomes of archaic populations (not only Neandertals, but also some anatomically modern people from the Upper Paleolithic, as well as other archaic populations, for example the Denisovans). It became clear that if there is a pattern to the encounters between natives and newcomers, it is one in which encounters end in creation of new life, not only death and conflict. Most of today's inhabitants of Eurasia carry a part of the Neandertal heritage, and thus the Neandertals never really disappeared. They still live in us and future research, aimed at a better understanding of what this legacy brings us, will have a great impact in the development of personalized medicine and benefit us, living humans, in many ways. It is therefore not a great surprise that the Nobel prize for physiology and medicine for 2022 was awarded for the work on paleogenomic research on Neandertals. There is still much to learn about the Neandertals, but we can learn a lot from them as well.