M. A. Akşit Koleksiyonundan

1

İlk İnsanın, Homo sapiens, sapiens, H. erectus ve Neandertal gibi sonu tükenecek mi? *

First Human being; Homo sapiens, sapiens, like H. erectus and Neanderthals, as being extinct?*

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***İnsan soyu tükenecek midir? Göç etmezse olabilir.**
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Mevcut yerleşim yerinde doğal olan hayvanlara bakılınca, geldiği kaynak yerler düşündürür. Van kedisi, İran kedisi diye tanımlama orijin kaynağı da tanımlamaktadır.

Peki insanın kaynağı neresidir. Görüntüye göre bakılması, yakın zamanı göstermektedir. Siyah olanlara bu nedenle Afrika Kökenli denilir ama, Amerika ve birçok ülkede asırlardır oldukları dışlanmamalıdır. Kısaca insanlarda tek merkezden dağılım olduğu, 170-300 bin yıl önce Afrika'da oluştuğu, genetik ve yapısal olarak belirgindir.

İnsana benzer türler, boyut, ayakta duranlar, H. erectus ve Neandertal türlerinde de milyonlarca yıl önce oldukları, dikkate alınınca, insan türünün de sonu gelecek midir? Yoksa tüm Evrenin oluşumu, büyük patlama gibi, yine atomların enerjiye dönüşümüne kadar sürecek midir?

Sevgi olmadan çoğalma olmayacağına göre, bir kaynaktan oluşması ve bunun yayılması, kısaca göç etmesi ile oluştuğu gerçeği bir olgudur.

Başlıca zamanımızda da Afrika Kökenli, Kafkasya Kökenli ve Sarı Irk denilen, Arabistan ile oluşan kol temel yapıdaki ayrışımı oluşturmaktadır.

Bu farklılaşma bir ayrıcalık ve bir üstünlük olmasa da kültürler bizden ve sizden diyerek dışladığı bir gerçektir.

Kültürel açıdan sosyal yapı; üst, orta ve alt sınıf diye ayrılması gözlenmekte ve bunun diğer şekilde de yayılması anlaşılmaktadır.

Hepimizin kardeş olduğu olgusunun ve göçlerin boyutu ile irdelenmeye çalışılacaktır.

Daha farlı bir boyut olarak daha önce var olan Homo erectus ve Neandertal yok oluşları incelendiğinde, bizler de bu ırk veya diğer kavgalar, savaşalar ve çevre kirliliği nedeniyle türümüzü yok edecek miyiz? Daha 200-300bin yıl geçmiş varken, diğerleri milyonlarca yıl, Dünyada var olmuşlardır. Aman dikkat etmeli, sevgi ve insanlıkta kalmalı, sonumuzu tüketmemeliyiz.

Özet

İlk İnsanın, Homo sapiens, sapiens, H. erectus ve Neandertal gibi sonu tükenecek mi?

Amaç: İnsanlar, Homo sapiens, sapiens türü, diğer kendisine benzeyen türler gibi, onlar, uzun süreçte Dünya'da kalmış olmalarına karşın, soyları tükenmiştir, yaşam amacı ile göçmüşler, insan türü de göçmüş, ancak bu varlığın devamlılığını sağlayacak mıdır? Bu Makalede İnanın kökeni üzerinde durulmaktadır.
Dayanaklar/Kaynaklar: Kaynaklar Ansiklopedik bilgi temelinde ele alınmıştır.
Giriş: Antropolojik veriler ile insanın ayakta yürüyen Homo erectus ve Neandertal 'den genetik farklı olduğu tanımlanmış olmakla, Evrene dağılımları irdelenmektedir.
Genel Yaklaşım; Anatomik benzerlikler ötesinde temel kanıt genetik olmalıdır ve buna göre Homo sapiens sapiensin göçü irdelenmiştir. Diğer türlere değinilmiştir.
Başlıca boyutlar: Ansiklopedik bilgi okunması için tam konulmuş, tüm veriler irdelenmemiştir.
Yaklaşım: Yaşamamızda farklı yapıda kişiler olmasına karşın, tümümüz bir genden, kısaca kardeş olarak yaratılmışız. Ayırımcılık bu açıdan insanlık dışıdır.
Sonuç ve Yorum: Hepimiz kardeş olarak, diğer örnekler gibi yok olmamak için, yaşam acısından göç unsurunu dikkate alarak, geleceğimizi, muasır medeniyet ötesinde, sevgi ve insanlıkta iken oluşturmalı, ayrımcılık temelindeki çatışmalara, kardeşlik içinde anlaşmalı, birlikte olmalıyız.
Anahtar Kelimeler: İnsan diğer türler gibi yok olmamalı

Outline

First Human being; Homo sapiens, sapiens, like H. erectus and Neanderthals, as being extinct?

AIM: Human being, as Homo sapiens, sapiens species, as like other standing up ones, stayed in this World, a long time, thus, now extinct; they migrate because of surviving; thus, Human being were also migrated, so, can this has been protected from extinction? This Article is mainly on the Human origin.
Grounding Aspects: Encyclopedic knowledge is taken, directly given, and evaluation.
Introduction: Anthropological findings as on evidence-based, Human being differs, genetically form Homo erectus and Neanderthal, and distribution of this World is discussed.
General Considerations: The Encyclopaedical knowledge given, for reading to whom it may concern.
Proceeding: All we are in brotherhood, even several different appearances, so, discriminancy is a humanistic unreality.
Notions and Conclusion: As we are all in brotherhood, like the other standing up species, as considering the migration for survive, being over the current civilization, in love at humanity confirmation, as diversity and discrimination may cause conflicts, so solve all problems by agreement and getting together with.
Key Words: As like other species, Human being not going to extinct

Giriş

Hayvanlardan farklı olarak iki ayak üstünde olan, yürüyen ve elini kullanan, ilk birim tür genetik insan türü değildirler. Homo erectus ve daha sonra Neandertal milyonlarca yıl kalmış, daha sonra silinmişlerdir.

Beyin büyüklüğü kriter alınmış, genetik olmasa da anatomik benzerliklere bakılmıştır. İnsanda daha fazla olması, sapiens; akıllı denilse de onların da sorunlarda göç ettikleri ve daha iyi yerlere yerleştikleri bir gerçektir. Dolaysıyla yaşayacak yerleri seçerek bulmuşlardır.

Acaba bizler, akıl fazla olduğu denilerek, savaşlar, birbirini yok etmek, atom ve hidrojen bombaları ile yok etmek olası görünmektedir. Neslin tükenmesine biz mi neden olacağız?

Savaşlar, çatışma şeklinde devam etmektedir. Güçler kendisine bağımlı kıldığı gruplar, terör ile hakimiyet kurmakta, bulundukları yerlerdeki zenginlikleri alıp kullanmaktadırlar. Güçlü benim demekte, olaylar devamlı sürmekte, milyonlarca insan ölmekte, göçmektedir.

622 Medine Antlaşması ile birey hakkı hukuki zemin bulmuş ve fetih kavramı oluşmuş, insanlar isteyerek katılmışlardır. Eşitlik; Örnek detay; Padişah mutfağında olan yiyecek, tüm topraklara yayılması zorunludur. Vezir parmağı, Hünkâr beğendi gibi adlar buradan gelmektedir. Her bir kabilenin kelimeleri lügat olarak kabul görmüştür. Kuran kelimeleri kullanılması teşvik edilmiştir. Bizi Osmanlı sömürdü diyene, o zaman petrol yoktu, kumunuzu mu sömürdü diye sormuş, o zaman demiryolu ilk defa Hicaz'a yapıldığı eklenmiştir. Sadece vergi alındığı, hizmetin götürüldüğü, bilinmelidir. Hakimiyet savaş ile değil, barış ile, antlaşma ötesi, birey hakkına uyum ile olabilir. Zaten Türk Ticaret Kanunu'nda belirtildiği gibi anlaşma olsa bile, birisi aleyhine olursa bu butlan, kabul edilebilir olamaz denilmektedir.

Bunun yanında çevre kirliliği nedeniyle bir yöreyi yaşanamaz hale getirmekteyiz. Yüksek enerji elde etmek yerine, her evin çatısına güneş enerjili elektrik pili oluşturulsa, kendi enerjisi dışında dışarıya da sevk edebilir. Bir akarsu hafif döndürülen çark ile sudan elektroliz ile hidrojen üretilirse, arabalara yakıt olur. Hidrojen yanması ile su oluşur. Ama bunlara yatırım beklenmez, dev kuruluşlar ziyan eder, kazanç isterler, daha doğrusu gelirlerini kaybederler.

Kültürel bakımdan bakılınca iki taraf gözlenebilir. Her bir bireyin hakkının korunması, diğer taraftan da dikta ile yönetimdir. Aile/klan kültüründe, ortak birey hakkı ile alınan Toy yapısı, diğer taraftan amir ile oluşan yönetim. Tarım kültüründe gelenek ve örfler ile kalıba sıkıştırılan insan ile bireyin bilgi ve rızası ile yapılanma olması karşılaştırılabilir. Endüstri kültüründe patron emrinde olan kişilik, diğer yanda kendi isteği ile araba alan, sorumluluk yüklenen birey. Yüksek Teknoloji kültüründe, Globalleşme ile emir ile yapılmalıdır yaklaşımı, seçim çözüm değildir diyen yapı ile, bireyin arzusuna göre yaklaşım yapılmalı diyen boyut. Birey Hakları Kültüründe, Civil Liberties, devlet hukuk düzenini TCK olduğu gibi, kişilik haklarını gözetmek üzere kurulmuştur yapısı olmaktadır. Sorun uygulanma boyutunda olmaktadır.

Kısaca insanların varlığı boyutu devamlılığı olanaklı iken, tüm Homo sapiens, sapiens türünü yok ediş boyutu da vardır. Bakalım ne olacak denirken, zaman süreci gözlememiz içinde aklını kullanır, kardeşlik içinde, barış yaparak yaşarlarsa, olmadığı, olmayacağı da belirgindir.

Bu makalede bu insan ve daha önceki varlıkların irdelemesi yapılmaktadır. Örnek veya ibret ile ders alan açısından önemlidir. Önce kendimize, yazar için kendisine ders olmalıdır.

İnsanlaştırma

Atatürk "***Ne mutlu Türküm diyene***" ifadesinde, insanlaştırma vardır, olay, bir ırk, kabileye ait olmak değildir.

"***Türk öğün, çalış, güven***" ifadesinde olan Türk tanımı da bir farklı yaklaşım değil, insan demektir. İslam vurgusu da benzerdir. Ey İnsan, Ey Nas, Ya Sin yaklaşımında olduğu gibi, insana hitap etmektedir.
Öğün; öğren, öğret anlamını taşır, Arapça ikra demektir, Kuran ilk emridir, okumak ötesi, eğitim almak, eğitim vermektir.
Arapça, ibadet kelimesinin, tapınma ile alakası yoktur. Çalışmak, çalışarak değer ve eser üretmek, emek demektir.
Güven ise inanma, dayanma, Arapça iman demektir.
Özet olarak: ***Türk öğün, çalış, güven;*** Ey İnsan, oku, eğitim al, eğitim ver, çalışarak değer eser üret ve inan, güven, imanlı ol demektir.

Bize her temaslarda Sülaledeki Atamızın öğüdü aklımıza gelir. Kanımız Albayrak rengi, yıldız kendimiz, idealler de hilal ise, bizler bir bayrağız. Bastığımız yer de dalgalanan bayrak gibi vatan olduğuna göre, nerede olursak olalım, sevgi üzere insanlıkta olalım anlamını taşır. Her insan aynı boyutta ise, onlarda bizimle birlikte, aynı bütünleşen boyuttayız demektir. Bunu algılamak, algılatmak görevimiz olmalıdır.

Amerika'da bir özel Neonatoloji ile ilgili 26 kişilik gezide, bizim otobüsün şoförü Afrika Amerikalı idi, Adı Fransızca olunca Fransızca *merhaba* dedim. *Babamlar oralardan gelmiş, bizde Fransızca konuşmak yasak* dedi. Selamımı da almadı. Akşam verilen çikolatalardan bir avuç aldım vermeye çalıştım. Sert bir şekilde, *niye* dedi. *Torun var mı* dedim, bir kız torunu varmış, *onun için* dedim. Elini arkasından çıkardım, avcunu açtım ve koydum, elini de kapattım. Sadece baktı. Ertesi gün şeker verdiler, uzattım, elini açtı ve aldı. Arkadaki arkadaşlar *Türkleşti* dediler. *Çikolata yok mu* diye sorunca da *kesin Türk* dediler. *Sevgi ve insanlıkta olana Türk derler* dediler. Sonra sohbetler, şarkılar ve birlikte oyunlar, biz halay, o ise bir zıplama ile bize katıldı.

Biz hepimiz profesör, o ise Afrika kökenli, resmi herhangi bir boyut olmadan, kardeşlik ile bütünleştik. Şoför, biz istemeden birçok şeyi ayarlamış, giderken çok rahat ettik. İşte bu insanlık, işte bu Türklük dedik. Atatürk'ü andık, saygılar sunduk.

İnsan, Homo sapiens, sapiens

Her bir tür kendi içinde bir değişim ve ayrıca malformasyon geçirmektedir. Bunlar kendi türü içindedir. 21 Trizomi, Down sendromu farklı bir genetik yapısında olsa bile insandır.
İnsanlar değişime uğraması ile, ayrıca her doğuda %2,5-5,0 majör, hafif farklılık, minör anomalilere ile %17 yakın bir ayrışım yaşanır. Bunlar homozigot değil, heterozigot olması ile daha da farklılaşma gözlenmektedir. Bu Homo erectus ve Neandertal ile aynı tür anlamında ele alınmamalıdır, genetik olarak imkânsız, ayrı türdür. Eski değerlendirmede, anatomik ve yapısal benzerlik ile insana türü ile bütünleştirilmeye çalışılmış, ancak genetik farklı yapıdırlar.

Kaynaklardan insan konusunu bir irdeleyelim.
İngilizce olarak tam kaynak, metin alınacaktır, diğer dillerde daha kısa olduğu anlaşılmaktadır.

Human, Wikipedia[1]

Humans, or **modern humans** (***Homo sapiens***), are the most common and widespread species of primate. A great ape characterized by their hairlessness, bipedalism, and high intelligence, humans have a large brain and resulting cognitive skills that enable them to thrive in varied environments and develop complex societies

and civilizations. Humans are highly social and tend to live in complex social structures composed of many cooperating and competing groups, from families and kinship networks to political states. As such, social interactions between humans have established a wide variety of values, social norms, languages, and rituals, each of which bolsters human society. The desire to understand and influence phenomena has motivated humanity's development of science, technology, philosophy, mythology, religion, and other conceptual frameworks.

Although some scientists equate the term "humans" with all members of the genus *Homo*, in common usage it generally refers to *Homo sapiens*, the only extant member. Other members of the genus *Homo* are known as archaic humans. Anatomically modern humans emerged around 300,000 years ago in Africa, evolving from *Homo heidelbergensis* or a similar species and migrating out of Africa, gradually replacing or interbreeding with local populations of archaic humans. For most of their history, humans were nomadic hunter-gatherers. Humans began exhibiting behavioral modernity about 160,000–60,000 years ago. The Neolithic Revolution, which began in Southwest Asia around 13,000 years ago (and separately in a few other places), saw the emergence of agriculture and permanent human settlement. As populations became larger and denser, forms of governance developed within and between communities, and a large number of civilizations have risen and fallen. Humans have continued to expand, with a global population of over 8 billion as of 2023.

Genes and the environment influence human biological variation in visible characteristics, physiology, disease susceptibility, mental abilities, body size, and life span. Though humans vary in many traits (such as genetic predispositions and physical features), any two humans are at least 99% genetically similar. Humans are sexually dimorphic: generally, males have greater body strength and females have a higher body fat percentage. At puberty, humans develop secondary sex characteristics. Females are capable of pregnancy, usually between puberty, at around 12 years old, and menopause, around the age of 50.

Humans are omnivorous, capable of consuming a wide variety of plant and animal material, and have used fire and other forms of heat to prepare and cook food since the time of *Homo erectus*. Humans can survive for up to eight weeks without food and several days without water. Humans are generally diurnal, sleeping on average seven to nine hours per day. Childbirth is dangerous, with a high risk of complications and death. Often, both the mother and the father provide care for their children, who are helpless at birth.

Humans have a large, highly developed, and complex prefrontal cortex, the region of the brain associated with higher cognition. Humans are highly intelligent, capable of episodic memory, have flexible facial expressions, self-awareness, and a theory of mind. The human mind is capable of introspection, private thought, imagination, volition, and forming views on existence. This has allowed great technological advancements and complex tool development to be possible through complex reasoning and the transmission of knowledge to subsequent generations. Language, art, and trade are defining characteristics of humans. Long-distance trade routes might have led to cultural explosions and resource distribution that gave humans an advantage over other similar species.

Etymology and definition

All modern humans are classified into the species *Homo sapiens*, coined by Carl Linnaeus in his 1735 work *Systema Naturae*.[2] The generic name "*Homo*" is a learned 18th-century derivation from Latin *homō*, which refers to humans of either sex.[3][4] The word *human* can refer to all members of the *Homo* genus,[5] although in common usage it generally just refers to *Homo sapiens*, the only extant species.[6] The name "*Homo sapiens*" means 'wise man' or 'knowledgeable man'.[7] There is disagreement if certain extinct members of the genus, namely Neanderthals, should be included as a separate species of humans or as a subspecies of *H. sapiens*.[5]

Human is a loanword of Middle English from Old French *humain*, ultimately from Latin *hūmānus*, the adjectival form of *homō* ('man' – in the sense of humankind).[8] The native English term *man* can refer to the species generally (a synonym for *humanity*) as well as to human males. It may also refer to individuals of either sex.[9]

Despite the fact that the word *animal* is colloquially used as an antonym for *human*,[10] and contrary to a common biological misconception, humans are animals.[11] The word *person* is often used interchangeably with *human*, but philosophical debate exists as to whether personhood applies to all humans or all sentient beings, and further if one can lose personhood (such as by going into a persistent vegetative state).[12]

Yorum

İnsanları tanımlamak için, genetik kotlardan daha çok, zekâ ve yapıcı veya yıkıcı özellikleri nedeniyle tarihte bıraktıkları izler ile de takip edilebilmektedir.

Kültürel yapıları onları yüzlerce yıl aynı yapıda olduğunun bir kanıta olmaktadır.

Aynı dönemde yaşayan Neandertallerin, ortadan kalktığı, bir varsayımına göre hiç karşılaşmadıkları belirtilmektedir. Kısaca insana benzer yaratıklar olmuş, ama genetik insan değildirler.
Homo insan demektir, sapiens de akıllı olmasının ifadesidir. Bu açıdan akıllı olmak insanın tanımlamaktadır.
İnsanın özelliği, ayakta durabilmesi, kılı azdır, vücut nadir kıllıdır, büyük beyin olup, işlevsel kullanabilir, uygarlıklar kurabilir. Yüksek sosyal yapısı ile, kültürel yapılar oluşturmakta, medeniyetleri oluşturabilmektedir. Aile, akrabalık ve diğer sosyal kimlikler ile daha yakınlaşma sağlayabilmektedir. Kurallar, örf, adetler yapılandırmakta, dil oluşturmakta, farklı kültür, kişilik ve devlet yapısı oluşturup, yönetilmekte, yönetmektedirler. Bilim, teknoloji, felsefe, inanışlar, mitoloji, destanlar ile çok farklı boyutlar ile de etkilenmektedirler.

Bunu farklı açıdan bakarsak: Görünüş: toplumda çeşitli estetik yapı ile bedeninin yapısı değiştirilmekte, peruk takarak saçı varmış rolü yapmaktadır. İşlevsel, büyük beyni kendi menfaat üzere, başkalarını ezmek ve basarak yükselmek istemektedir. Sosyal yapı ile bizden, sizden diyerek, düşmanlar oluşturmakta, onları yok etmeye, ezmeye, köle yapmaya çalışmaktadır.

Kurallar ve örf adı altında kalıpsal yapıda olarak, kontrol etmeye çalışmaktadır. Olmaz ise dışlamaktadır. Tüm sosyal yapılanma sınıf yaratarak başkasını ezmek, ezilenin de onunla gurur duyması, köleliği kabul etmesi sağlanmaktadır. Tüm bilim, teknoloji, felsefe, inanışlar bir üstün sınıf yaratıp, diğerlerinin çobanı olarak onları kurtarması üzerine yapılanmaktadır.

NOT: İki farklı yapı olmakta, biri barış, sevgi üzerine insanlık, diğeri ise çatışma, bozgunculuk ve birey hakkını kaldırmak, izine bağlayarak diktanın elemanı olmasını dağlamaktır. Bilgilendirme ve eğitim ile aydınlatma ama rıza, sorumluluk bireye verme boyutu ile diğerleri çatışmaktadır.

Homo/İnsan türlerinin Dünya'daki dağılımları

Şekil 1: Sarı Homo erectus, koyu sarı/turuncu Neandertal, kırmızı Homo sapiens olmaktadır. Neandertallerin merkezi Filistin iken, Avrupa'da işaret edilen nokta yerlerde arkeolojik kalıntıları ile modern insan ile genetik etkileşim olduğu belirtilmektedir.

İnsan türünü irdelemeye devam etmeden önce, Homo erectus ile Neandertal türüne bakılmalıdır.

Homo erectus, Wikipedia[2]

Homo erectus (/ˌhoʊmoʊ əˈrɛktəs/; meaning "upright man") is an extinct species of archaic human from the Pleistocene, with its earliest occurrence about 2 million years ago.[2] Its specimens are among the first recognizable members of the genus *Homo*.

Several human species, such as *H. heidelbergensis* and *H. antecessor*, appear to have evolved from *H. erectus*, and Neanderthals, Denisovans, and modern humans are in turn generally considered to have evolved from *H. heidelbergensis*.[3] *H. erectus* was the first human ancestor to spread throughout Eurasia, with a continental range extending from the Iberian Peninsula to Java. Asian populations of *H. erectus* may be ancestral to *H. floresiensis*[4] and possibly to *H. luzonensis*.[5] The last known population of *H. erectus* is *H. e. soloensis* from Java, around 117,000–108,000 years ago.[1]

H. erectus had a more modern gait and body proportions, and was the first human species to have exhibited a flat face, prominent nose, and possibly sparse body hair coverage. Though the species' brain size certainly exceeds that of ancestor species, capacity varied widely depending on the population. In earlier populations, brain development seemed to cease early in childhood, suggesting that offspring were largely self-sufficient at birth, thus limiting cognitive development through life. *H. erectus* was an apex predator;[6] sites generally show consumption of medium to large animals, such as bovines or elephants, and suggest the development of predatory behavior and coordinated hunting. *H. erectus* is associated with the Acheulean stone tool industry, and is postulated to have been the earliest human ancestor capable of using fire,[7] hunting and gathering in coordinated groups, caring for injured or sick group members, and possibly seafaring and art (though examples of art are controversial, and are otherwise rudimentary and few and far between).

H. erectus males and females may have been roughly the same size as each other (i.e. exhibited reduced sexual dimorphism), which could indicate monogamy in line with general trends exhibited in primates. Size, nonetheless, ranged widely from 146–185 cm (4 ft 9 in – 6 ft 1 in) in height and 40–68 kg (88–150 lb) in weight. It is unclear if *H. erectus* was anatomically capable of speech, though it is postulated they communicated using some proto-language.

Yorum

İlk ayağa kalkan tür olarak, kullanmak için alet yapması, ateşi kullanması ve yatacak kapalı bir yer yapabilmesi ile önemli arkeolojik iz bırakan bir yapıda olmuştur.
2 milyon yıl önce saptanmış, Java adasında ise 117-108bin yıl önce saptanmıştır.
Farklı bulunan yerlere göre adlar almıştır.

Taxonomy

Naming

Contrary to the view Charles Darwin expressed in his 1871 book *Descent of Man*, many late-19th century evolutionary naturalists postulated that Asia, not Africa, was the birthplace of humankind as it is midway between Europe and America, providing optimal dispersal routes throughout the world (the Out of Asia theory). Among these was German naturalist Ernst Haeckel, who argued that the first human species evolved on the now-disproven hypothetical continent "Lemuria" in what is now Southeast Asia, from a species he termed "*Pithecanthropus alalus*" ("speechless apeman").[8] "Lemuria" had supposedly sunk below the Indian Ocean, so no fossils could be found to prove this. Nevertheless, Haeckel's model inspired Dutch scientist Eugène Dubois to journey to the Dutch East Indies. Because no directed expedition had ever discovered human fossils (the few known had all been discovered by accident), and the economy was strained by the Long Depression, the Dutch government refused to fund Dubois. In 1887, he enlisted in the Dutch East India Army as a medical officer, and was able to secure a post in 1887 in the Indies to search for his "missing link" in his spare time.[9] On Java, he found a skullcap in 1891 and a femur in 1892 (Java Man) dating to the late Pliocene or early Pleistocene at the Trinil site along the Solo River, which he named *Pithecanthropus erectus* ("upright apeman") in 1893. He attempted unsuccessfully to convince the European scientific community that he had found an upright-walking ape-man. Given few fossils of ancient humans had even been discovered at the time, they largely dismissed his findings as a malformed non-human ape.[10]

The significance of these fossils would not be realized until the 1927 discovery of what Canadian paleoanthropologist Davidson Black called "*Sinanthropus pekinensis*" (Peking Man) at the Zhoukoudian cave near Beijing, China. Black lobbied across North America and Europe for funding to continue excavating the site,[11] which has since become the most productive *H. erectus* site in the world.[12] Continued interest in Java led to further *H. erectus* fossil discoveries at Ngandong (Solo Man) in 1931, Mojokerto (Java Man) in 1936, and Sangiran (Java Man) in 1937. The Sangiran site yielded the best preserved Java Man skull.[13] German paleoanthropologist Franz Weidenreich provided much of the detailed description of the Chinese specimens in several monographs. The original specimens were lost during the Second Sino-Japanese War after an attempt to smuggle them out of China for safekeeping. Only casts remain.

Similarities between Java Man and Peking Man led Ernst Mayr to rename both as *Homo erectus* in 1950. Throughout much of the 20th century, anthropologists debated the role of *H. erectus* in human evolution. Early in the century, due in part to the discoveries at Java and Zhoukoudian, the belief that modern humans first evolved in Asia was widely accepted. A few naturalists—Charles Darwin the most prominent among them—theorized that humans' earliest ancestors were African. Darwin had pointed out that chimpanzees and gorillas, humans' closest relatives, evolved and exist only in Africa.[14] Darwin did not include orangutans among the great apes of the Old World, likely because he thought of orangutans as primitive humans rather than apes.[15] While Darwin considered Africa as the most probable birthplace of human ancestors, he also made the following statement about the geographic location of human origins in his book *The Descent of Man, and Selection in Relation to Sex*: "... it is useless to speculate on this subject; for two or three anthropomorphous apes, one the Dryopithecus …, existed in Europe during the Miocene age; and since so remote a period the earth has certainly undergone many great revolutions, and there has been ample time for migration on the largest scale." (1889, pp. 155-156).

In 1949, the species was reported in Swartkrans Cave, South Africa, by South African paleoanthropologists Robert Broom and John Talbot Robinson, who described it as "*Telanthropus capensis*".[16] *Homo* fossils have also been reported from nearby caves, but their species designation has been a tumultuous discussion. A few North African sites have additionally yielded *H. erectus* remains, which at first were classified as "*Atlantanthropus mauritanicus*" in 1951.[17] Beginning in the 1970s, propelled most notably by Richard Leakey, more were being unearthed in East Africa predominantly at the Koobi Fora site, Kenya, and Olduvai Gorge, Tanzania.[18]

Archaic human fossils unearthed across Europe used to be assigned to *H. erectus*, but have since been separated as *H. heidelbergensis* as a result of British physical anthropologist Chris Stringer's work.[19]

Evolution

Hominin timeline

−10 —	**Miocene**	← Earlier apes
–		← Gorilla split
−9 —		← Chimpanzee split
–		← Earliest bipedal
−8 —	**Pliocene**	← Earliest stone tools
–		← Dispersal beyond Africa
−7 —		← Earliest fire / cooking
–	**Pleistocene**	← Earliest rock art
−6 —		← Earliest clothes
–	**Hominini**	← Modern humans
−5 —	*Nakalipithecus*	
–	*Ouranopithecus*	
−4 —	*Oreopithecus*	
–	*Sahelanthropus*	
−3 —	*Orrorin*	
–	*Ardipithecus*	
−2 —	*Australopithecus*	
–	*H. habilis*	
−1 —	*H. erectus*	
–	*H. heidelbergensis*	
0 —	*Homo sapiens*	
	Neanderthals	
	Denisovans	
(million years ago)		

Map of the distribution of Middle Pleistocene (Acheulean) cleaver finds

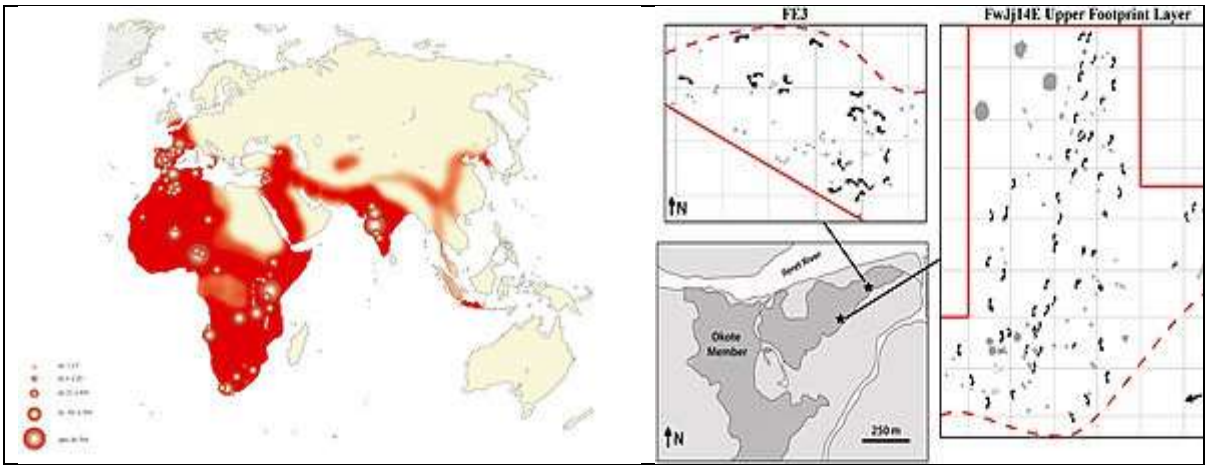
It has been proposed that *H. erectus* evolved from *H. habilis* about 2 Mya, though this has been called into question because they coexisted for at least a half a million years. Alternatively, a group of *H. habilis* may have been reproductively isolated, and only this group developed into *H. erectus* (cladogenesis).[20]

Because the earliest remains of *H. erectus* are found in both Africa and East Asia (in China as early as 2.1 Mya,[21][22][23] in South Africa 2.04 Mya[2][24]), it is debated where *H. erectus* evolved. A 2011 study suggested

that it was *H. habilis* who reached West Asia from Africa, that early *H. erectus* developed there, and that early *H. erectus* would then have dispersed from West Asia to East Asia (Peking Man), Southeast Asia (Java Man), back to Africa (*Homo ergaster*), and to Europe (Tautavel Man), eventually evolving into modern humans in Africa.[25][26] Others have suggested that *H. erectus*/*H. ergaster* developed in Africa, where it eventually evolved into modern humans.[27][28]

H. erectus had reached Sangiran, Java, by 1.8 Mya,[29] and a second and distinct wave of *H. erectus* had colonized Zhoukoudian, China, about 780 kya. Early teeth from Sangiran are bigger and more similar to those of basal (ancestral) Western *H. erectus* and *H. habilis* than to those of the derived Zhoukoudian *H. erectus*. However, later Sangiran teeth seem to reduce in size, which could indicate a secondary colonization event of Java by the Zhoukoudian or some closely related population.[30]

Homo erectus 'un dağılımı



Şekil 2: Geniş alanda göç ettiği görülmektedir. Kenya'da oluşan ayak izleri ve taşlaşması ile yürümeleri ve oluşturdukları izler gözlenebilmektedir.

Subspecies

"Wushan Man" was proposed as *Homo erectus wushanensis*, but is now thought to be based upon fossilized fragments of an extinct non-hominin ape.[31]

Since its discovery in 1893 (Java Man), there has been a trend in paleoanthropology of reducing the number of proposed species of *Homo*, to the point where *H. erectus* includes all early (Lower Paleolithic) forms of *Homo* sufficiently derived from *H. habilis* and distinct from early *H. heidelbergensis* (in Africa also known as *H. rhodesiensis*).[32] It is sometimes considered as a wide-ranging, polymorphous species.[33]

Due to such a wide range of variation, it has been suggested that the ancient *H. rudolfensis* and *H. habilis* should be considered early varieties of *H. erectus*.[34][35] The primitive *H. e. georgicus* from Dmanisi, Georgia has the smallest brain capacity of any known Pleistocene hominin (about 600 cc), and its inclusion in the species would greatly expand the range of variation of *H. erectus* to perhaps include species as *H. rudolfensis*, *H. gautengensis*, *H. ergaster*, and perhaps *H. habilis*.[36] However, a 2015 study suggested that *H. georgicus* represents an earlier, more primitive species of *Homo* derived from an older dispersal of hominins from Africa, with *H. ergaster/erectus* possibly deriving from a later dispersal.[37] *H. georgicus* is sometimes not even regarded as *H. erectus*.[38][39]

It is debated whether the African *H. e. ergaster* is a separate species (and that *H. erectus* evolved in Asia, then migrated to Africa),[40] or is the African form (*sensu lato*) of *H. erectus* (*sensu stricto*). In the latter, *H. ergaster* has also been suggested to represent the immediate ancestor of *H. erectus*.[41] It has also been suggested that *H. ergaster* instead of *H. erectus*, or some hybrid between the two, was the immediate ancestor of other archaic humans and modern humans.[*citation needed*] It has been proposed that Asian *H. erectus* have several unique characteristics from non-Asian populations (autapomorphies), but there is no clear consensus on what these characteristics are or if they are indeed limited to only Asia. Based on supposed derived characteristics, the 120 kya Javan *H. e. soloensis* has been proposed to have speciated from *H. erectus*, as *H. soloensis*, but this has been challenged because most of the basic cranial features are maintained.[42] In a wider sense, *H. erectus* had mostly

been replaced by *H. heidelbergensis* by about 300 kya, with possible late survival of *H. erectus soloensis* in Java an estimated 117-108 kya.[1]

- *H. e. bilzingslebenensis* (Vlček 1978): Originally described from a series of skulls from Bilzingsleben, with the individual of Vertesszöllös being referred. [43] The material historically referred to this taxon are now affiliated with Neanderthals and the hominins at Sima de los Huesos.[44]
- *H. e. capensis* (Broom 1917): A variant of "*Homo capensis*",[45] a tax-on erected from a skull from South Africa formally classified as a type of "race" but is now considered a representative of the Khoisan.[46]
- *H. e. chenchiawoensis*: A name utilized in a 2007 review of Chinese archeology; the text suggests that it and *gongwanglingensis* are contenders in taxonomy[47] (despite this name not appearing in the literature).
- *H. e. erectus* (Dubois 1891):[48] The Javanese specimens of *H. erectus* were once classified as a distinct subspecies in the 1970s. The cranium from Trinil is the holotype.[49]
- *H. e. ergaster* (Groves and Mazák 1975): Antón and Middleton (2023) suggested that *ergaster* should be disused based on poor diagnoses.[50] The name *Homo erectus ergaster georgicus* was created to classify the Dmanisi population as a subspecies of *H. e. ergaster*, but quadrinomials are not supported by the ICZN.[51]
- *H. e. georgicus* (Gabounia 1991):[52] This hypothetical subspecific designation unites the D2600 cranium with the remainder of the Dmanisi sample, a connection that was, at the time, controversial and was only suggested if the single-species hypothesis could be proven true.[53]
- *H. e. gongwanglingensis*: A name utilized in a 2007 review of Chinese archeology; the text suggests that it and *chenchiawoensis* are contenders in taxonomy.[47] Rukang (1992) notes that this taxon was born in a "subspecies fever".[54]
- *H. e. habilis* (Leakey, Tobias, and Napier 1964): D.R. Hughes believed that the Olduvai specimens were not distinct enough to be assigned to *Australopithecus*, so he created this taxon, as an early variation of *H. erectus*.[55]
- *H. e. heidelbergensis* (Schoetensack 1908): This taxon was used as an alternative to standard *H. heidelbergensis* during the middle 20th century, and it was used as a Eurocentric devision of the wider Middle Pleistocene hominin morph.[56]
- *H. e. hexianensis* (Huang 1982): Established based on the Hexian cranium.[57]
- *H. e. hungaricus* (Naddeo 2023): A Hungarian paper submitted to a conference lists this subspecies as an alternate name for the Vertesszöllös remains.[58]
- *H. e. lantianensis* (Ju-Kang 1964): Based on hominin fossils discovered in Lantian, originally named as a species of *Sinanthropus* and then reclassified as a subspecies.[59]
- *H. e. leakeyi* (Heberer 1963): A conditional name and thus unavailable for taxonomic use, once used to describe OH 9. The replacement name is *louisleakeyi*.[60] It received limited use as a subspecies.[61]
- *H. e. mapaensis* (Kurth 1965): A name that was proposed for the Maba cranium, although the use of the word 'perhaps' was interpreted by the Paleo Core database to be a conditional proposal and thus not available for valid reuse under the ICZN. Groves (1989) classified it as a subspecies of *H. sapiens*, and Howell (1999) did not assign the species to a genus.[62]
- *H. e. mauritanicus* (Arambourg 1954): A subspecies that received limited use as a descriptor for the cranial and mandibular material discovered at Tighenif.[61]
- *H. e. narmadensis* (Sonakia 1984): The name given to the Narmada cranium.[63]
- *H. e. newyorkensis* (Laitman and Tattersall 2001): A name based on the Sambungmacan 3 cranium.[64]
- *H. e. ngandongensis* (Sartono 1976): A name that was used in the process of splitting Pithecanthropus into many subspecies.[65]
- *H. e. olduvaiensis*: A subspecies that described the OH 9 cranium, compared to the Bilzingsleben cranial fragments.[66]
- *H. e. pekinensis* (Black and Zdansky 1927): Originally assigned the type of *Sinanthropus* based on a single molar.[67] Antón and Middleton (2023) suggested that Zhoukoudian and Nanjing may be referrable under this name if they exhibit enough discontinuity from *H. erectus* proper.[50]
- *H. e. reilingensis* (Czarnetzki 1989): Referring to a single cranial fragment, this subspecies is now considered a member of the Neanderthal lineage.[68]
- *H. e. soloensis* (Oppenoorth 1932): The original name devised by Oppenoorth for the Ngandong crania.[69]

- *H. e. tautavelensis* (de Lumley and de Lumley 1971): Referring to the remains discovered at Arago, with many preferring allocation to *Homo heidelbergensis*.[70] The remains were determined not to be *H. erectus* by Antón and Middleton (2023).[50]
- *H. e. trinilensis* (Sartono 1976): A tentative classification scheme, thus making the name conditional and unable for use.[71]
- *H. e. wadjakensis* (Dubois 1921): A species established by Eugene Dubois based on the Wajak skulls.[72] Pramujiono classified these materials as a subspecies, and incorrectly self-published the name as *wajakensis*.[73]
- *H. e. wushanensis* (Huang and Fang 1991): Originally conceived as a hominin, the remains this taxon is founded on are more likely referred to Ponginae.[74][75]
- *H. e. yuanmouensis* (Li *et al.* 1977): Based on hominin remains[76] that Antón and Middleton (2023) suggest do not belong to the taxon H. erectus, although they do not provide an alternate classification.[50]

Descendants and synonyms

Homo erectus is the most long-lived species of *Homo*, having survived for almost two million years. By contrast, *Homo sapiens* emerged about a third of a million years ago.

Regarding many archaic humans, there is no definite consensus as to whether they should be classified as subspecies of *H. erectus* or *H. sapiens* or as separate species.

- African *H. erectus* candidates
  - *Homo ergaster* (or "African *H. erectus*")
  - *Homo naledi*
- Eurasian *H. erectus* candidates:
  - *Homo antecessor*
  - *Homo heidelbergensis*
- *Homo floresiensis*[77]
- *Homo rhodesiensis*
- the Narmada fossil, discovered in 1982 in Madhya Pradesh, India, was at first suggested as *H. erectus* or *Homo erectus narmadensis*.[78]

Meganthropus, based on fossils found in Java, dated to between 1.4 and 0.9 Mya, was tentatively grouped with *H. erectus* in contrast to earlier interpretations of it as a giant species of early human[32] although older literature has placed the fossils outside of *Homo* altogether.[79] However, Zanolli et al. (2019) judged *Meganthropus* to be a distinct genus of extinct ape.[80]

Yorum

İnsanın ilk atasını bulmak, kendi ülkelerinde olduğu iddiası ve yapısal farklılıklar ile özel, özgün olduğu iddiasında olunduğu anlaşılmaktadır.

Benzer şekilde Afrikalı olanların farklı tür olduğu, hatta birçok kabile, kavim kendisinin ayrıcalıklı yapmak için genetik çalışmalar yapmışlardır. Ermeniler Orta Asya Türk kabileleri ile eşleşmiş, Kürtlerin de Türk boyları ile eşleştiği gözlenmiştir.

Bu açıdan yapısal, anatomik benzerlik değil genetik olarak tanımlanmalıdır.

Anatomy

Head

Homo erectus featured a flat face compared to earlier hominins; pronounced brow ridge; and a low, flat skull.[81][82] The presence of sagittal, frontal, and coronal keels, which are small crests that run along these suture lines, has been proposed to be evidence of significant thickening of the skull, specifically the cranial vault. CT scan analyses reveal this to not be the case. However, the squamous part of occipital bone, particularly the internal occipital crest, at the rear of the skull is notably thicker than that of modern humans, likely a basal (ancestral) trait.[82][83] The fossil record indicates that *H. erectus* was the first human species to have featured a projecting nose, which is generally thought to have evolved in response to breathing dry air in order to retain moisture.[84] American psychologist Lucia Jacobs hypothesized that the projecting nose instead allowed for distinguishing the direction different smells come from (stereo olfaction) to facilitate navigation and long-distance migration.[85]

The average brain size of Asian *H. erectus* is about 1,000 cc (61 cu in). However, markedly smaller specimens have been found in Dmanisi, Georgia (*H. e. georgicus*); Koobi Fora and Olorgesailie, Kenya; and possibly Gona,

Ethiopia. Overall, *H. erectus* brain size varies from 546–1,251 cc (33.3–76.3 cu in),[86] which is greater than the range of variation seen in modern humans and chimps, though less than that of gorillas.[*citation needed*]
In an article published in 2021 titled "Interpopulational variation in human brain size: Implications for hominin cognitive phylogeny," it was found that the brain size of Asian *H. erectus* over the last 600,000 years overlaps significantly with modern human populations. Significantly, some small brained modern populations showed greater affinity with *H. erectus* than they did with other large brained and large bodied modern populations. The paper points out methodological flaws in current understanding of brain size increase in human evolution, where species averages are compared with fossils, which overlooks interpopulational variation. It also overlooks the fact that some modern populations have not seen any dramatic brain size increase relative to *H. erectus* with most of the increase occurring in northern populations, which has the result of obscuring interpopulational variation. As the authors write '...the increase in the mean of *H. sapiens* cranial capacity is to a large extent due to an increase in the upper limit with a much less pronounced increase in the lower limit relative to our *H. erectus* sample. And this increase in the upper limit seems to be more pronounced in northern populations – which may be a result of correlated increases in body size in addition to climatic factors. Consequently, the authors argue that purely based on brain size similarities, Asian *H. erectus* could be re-classified as a subspecies of *H. sapiens*, that is *H. sapiens soloensis* - as was suggested by earlier authors.[87]
Dentally, *H. erectus* have the thinnest enamel of any Plio–Pleistocene hominin. Enamel prevents the tooth from breaking from hard foods, but impedes shearing through tough foods. The bodies of the mandibles of *H. erectus*, and all early *Homo*, are thicker than those of modern humans and all living apes. The mandibular body resists torsion from the bite force or chewing, meaning their jaws could produce unusually powerful stresses while eating, but the practical application of this is unclear. Nonetheless, the mandibular bodies of *H. erectus* are somewhat thinner than those of early *Homo*. The premolars and molars also have a higher frequency of pits than *H. habilis*, suggesting *H. erectus* ate more brittle foods (which cause pitting). These all indicate that the *H. erectus* mouth was less capable of processing hard foods and more at shearing through tougher foods, thus reducing the variety of foods it could process, likely as a response to tool use.[88]

Body

Like modern humans, *H. erectus* varied widely in size, ranging from 146–185 cm (4 ft 9 in – 6 ft 1 in) in height and 40–68 kg (88–150 lb.) in weight, thought to be due to regional differences in climate, mortality rates, or nutrition.[89][90] Among primates, this marked of a response to environmental stressors (phenotypic plasticity) is only demonstrated in modern humans.[91][92][93]
Like modern humans and unlike other great apes, there does not seem to have been a great size disparity between *H. erectus* males and females (size-specific sexual dimorphism), though there is not much fossil data regarding this.[94] Brain size in two adults from Koobi Fora measured 848 and 804 cc (51.7 and 49.1 cu in),[86] and another significantly smaller adult measured 691 cc (42.2 cu in), which could possibly indicate sexual dimorphism, though sex was undetermined.[20] Another case that depicts the difficulty of assigning sex to the fossil record is a few samples taken in Olduvai Gorge. In 1960, in Olduvai Gorge two skulls identified as OH12 and OH9, were found to be that of *H. erectus* with a cranial capacities of 1000 cc and 700 cc.[95] It is unclear if sexual dimorphism is at play here since the remains are fragmentary.[95] If *H. erectus* did not exhibit sexual dimorphism, then it is possible that they were the first in the human line to do so, though the fragmentary fossil record for earlier species makes this unclear. If yes, then there was a substantial and sudden increase in female height.[96] Certain features of sexual dimorphism are often identified in the possibility of determining sex such as lack of muscle marking.[97]
H. erectus had about the same limb configurations and proportions as modern humans, implying humanlike locomotion,[98] the first in the *Homo* lineage.[91] *H. erectus* tracks near Ileret, Kenya, also indicate a human gait.[99] A humanlike shoulder suggests an ability for high speed throwing.[100] It was once thought that Turkana boy had 6 lumbar vertebra instead of the 5 seen in modern humans and 11 instead of 12 thoracic vertebrae, but this has since been revised, and the specimen is now considered to have exhibited a humanlike curvature of the spine (lordosis) and the same number of respective vertebrae.[101]
It is largely unclear when human ancestors lost most of their body hair. Genetic analysis suggests that high activity in the melanocortin 1 receptor, which would produce dark skin, dates back to 1.2 Mya. This could indicate the evolution of hairlessness around this time, as a lack of body hair would have left the skin exposed to harmful UV radiation.[102] It is possible that exposed skin only became maladaptive in the Pleistocene, because the increasing tilt of the Earth (which also caused the ice ages) would have increased solar radiation bombardment-which would suggest that hairlessness first emerged in the australopithecines.[103] However, australopithecines seem to have lived at much higher, much colder elevations—typically 1,000–1,600 m (3,300–5,200 ft) where the

nighttime temperature can drop to 10 or 5 °C (50 or 41 °F)—so they may have required hair to stay warm, unlike early *Homo* which inhabited lower, hotter elevations.[104] Populations in higher latitudes potentially developed lighter skin to prevent vitamin D deficiency.[105] A 500–300 kya *H. erectus* specimen from Turkey was diagnosed with the earliest known case of tuberculous meningitis, which is typically exacerbated in dark-skinned people living in higher latitudes due to vitamin D deficiency.[106] Hairlessness is generally thought to have facilitated sweating,[107] but reduction of parasite load and sexual selection have also been proposed.[108][109]

Metabolism

The 1.8 Ma Mojokerto child specimen from Java, who died at about 1 year of age, presented 72–84% of the average adult brain size, which is more similar to the faster brain growth trajectory of great apes than modern humans. This indicates that *H. erectus* was probably not cognitively comparable to modern humans, and that secondary altriciality—an extended childhood and long period of dependency due to the great amount of time required for brain maturation—evolved much later in human evolution, perhaps in the modern human/Neanderthal last common ancestor.[110] It was previously believed that, based on the narrow pelvis of Turkana boy, *H. erectus* could only safely deliver a baby with a brain volume of about 230 cc (14 cu in), equating to a similar brain growth rate as modern humans to achieve the average adult brain size of 600–1,067 cc (36.6–65.1 cu in). However, a 1.8 Ma female pelvis from Gona, Ethiopia, shows that *H. erectus* babies with a brain volume of 310 cc (19 cu in) could have been safely delivered, which is 34–36% the mean adult size, compared to 40% in chimps and 28% in modern humans. This more aligns with the conclusions drawn from the Mojokerto child.[94] A faster development rate could indicate a lower expected lifespan.[111]

Based on an average mass of 63 kg (139 lb.) for males and 52.3 kg (115 lb.) for females, the daily energy expenditure (DEE)—the amount of calories metabolized in one day—was estimated to be about 2271.8 and 1909.5 kcal, respectively. This is similar to that of earlier *Homo*, despite a marked increase in activity and migratory capacity, likely because the longer legs of *H. erectus* were more energy-efficient in long-distance movement. Nonetheless, the estimate for *H. erectus* females is 84% higher than that for *Australopithecus* females, possibly due to an increased body size and a decreased growth rate.[112] A 2011 study, assuming high energy or dietary fat requirements based on the abundance of large game animals at *H. erectus* sites, calculated a DEE of 2,700–3,400 kcal of which 27–44% derived from fat, and 44–62% of the fat from animal sources. In comparison, modern humans with a similar activity level have a DEE of 2,450 calories, of which 33% derives from fat, and 49% of the fat from animals.[113]

Bone thickness

The cortical bone (the outer layer of the bone) is extraordinarily thickened, particularly in East Asian populations. The skullcaps have oftentimes been confused with fossil turtle carapaces,[114] and the medullary canal in the long bones (where the bone marrow is stored, in the limbs) is extremely narrowed (medullary stenosis). This degree of thickening is usually exhibited in semi-aquatic animals which used their heavy (pachyo-steosclerotic) bones as ballasts to help them sink, induced by hypothyroidism. Male specimens have thicker cortical bone than females.[115]

It is largely unclear what function this could have served. All pathological inducers would leave scarring or some other indicator not normally exhibited in *H. erectus*. Before more complete skeletons were discovered, Weidenreich suggested *H. erectus* was a gigantic species, thickened bone required to support the massive weight. It was hypothesized that intense physical activity could have induced bone thickening, but in 1970, human biologist Stanley Marion Garn demonstrated there is a low correlation between the two at least in modern humans. Garn instead noted different races have different average cortical bone thicknesses, and concluded it is genetic rather than environmental. It is unclear if the condition is caused by increased bone apposition (bone formation) or decreased bone resorption, but Garn noted the stenosis is quite similar to the congenital condition in modern humans induced by hyper-apposition. In 1985, biological anthropologist Gail Kennedy argued for resorption as a result of hyperparathyroidism caused by hypocalcemia (calcium deficiency), a consequence of a dietary shift to low-calcium meat. Kennedy could not explain why the calcium metabolism of *H. erectus* never adjusted.[115] In 1985, American paleoanthropologist Mary Doria Russell and colleagues argued the supraorbital torus is a response to withstanding major bending moment which localizes in that region when significant force is applied through the front teeth, such as while using the mouth as a third hand to carry objects.[116]

In 2004, Noel Boaz and Russel Ciochon suggested it was a result of a cultural practice, wherein *H. erectus* would fight each other with fists, stones, or clubs to settle disputes or battle for mates, since the skull is reinforced in key areas. The mandible is quite robust, capable of absorbing heavy blows (no "glass jaw"); the heavy brow ridge protects the eyes, and transitions into a bar covering the ears, connecting all the way in the back of the skull, meaning blows to any of these regions can be effectively dissipated across the skull; and the sagittal keel protects

the top of the braincase. Many skullcaps bear usually debilitating fractures, such as the Peking Man skull X, yet they can show signs of surviving and healing. Anthropologist Peter Brown suggested a similar reason for the unusual thickening of the modern Australian Aboriginal skull, a result of a ritual popular in central and southeast Australian tribes where adversaries would wack each other with waddies (sticks) until knockout.[114]

Yorum

İnsanlarla yapısal farklılıklar olacağı belirgindir ama bu mukayese yapmayı gereksiz kılmalıdır. İşlev karşılaştırılabilir ama bu benzerlik ötesine geçemez.
Zamanımızda da Afrika pigmeler/cüceler ile farklı yapımız belirgin, ama aynı türde olmamız da bir hakikattir.

Culture

Social structure

The only fossil evidence regarding *H. erectus* group composition comes from 4 sites outside of Ileret, Kenya, where 97 footprints made 1.5 Mya were likely left by a group of at least 20 individuals. One of these trackways, based on the size of the footprints, may have been an entirely male group, which could indicate they were some specialised task groups, such as a hunting or foraging party, or a border patrol. If correct, this would also indicate sexual division of labour, which distinguishes human societies from those of other great apes and social mammalian carnivores. In modern hunter gatherer societies who target large prey items, typically male parties are dispatched to bring down these high-risk animals, and, due to the low success rate, female parties focus on more predictable foods.[99] Based on modern day savanna chimp and baboon group composition and behavior, *H. erectus ergaster* may have lived in large, multi-male groups in order to defend against large savanna predators in the open and exposed environment.[117] However, dispersal patterns indicate that *H. erectus* generally avoided areas with high carnivore density.[118] It is possible that male–male bonding and male–female friendships were important societal aspects.[117]

Because *H. erectus* children had faster brain growth rates, *H. erectus* likely did not exhibit the same degree of maternal investment or child-rearing behaviours as modern humans.[94]

Because *H. erectus* males and females are thought to have been about the same size compared to other great apes (exhibit less size-specific sexual dimorphism), it is generally hypothesized that they lived in a monogamous society, as reduced sexual dimorphism in primates is typically correlated with this mating system.[96] However, it is unclear if *H. erectus* did in fact exhibit humanlike rates of sexual dimorphism.[20] If they did, then it would mean only female height increased from the ancestor species, which could have been caused by a shift in female fertility or diet, and/or reduced pressure on males for large size. This in turn could imply a shift in female behavior which made it difficult for males to maintain a harem.[119]

Food

Increasing brain size is often directly associated with a meatier diet and resultant higher caloric intake. Human entomophagy and therefore an increase in protein consumption through insects has also been proposed as a possible cause. However, it is also possible that the energy-expensive guts decreased in size in *H. erectus*, because the large ape gut is used to synthesize fat by fermenting plant matter which was replaced by dietary animal fat, allowing more energy to be diverted to brain growth. This would have increased brain size indirectly while maintaining the same caloric requirements of ancestor species. *H. erectus* may have also been the first to use a hunting and gathering food collecting strategy as a response to the increasing dependence on meat. With an emphasis on teamwork, division of labor, and food sharing, hunting and gathering was a dramatically different subsistence strategy from previous modes.[88][113]

H. erectus sites frequently are associated with assemblages of medium- to large-sized game, namely elephants, rhinos, hippos, bovine, and boar. *H. erectus* would have had considerable leftovers, potentially pointing to food sharing or long-term food preservation (such as by drying) if most of the kill was indeed utilized. It is possible that *H. erectus* grew to become quite dependent on large-animal meat, and the disappearance of *H. erectus* from the Levant is correlated with the local extinction of the straight-tusked elephant.[113] Nonetheless, *H. erectus* diet likely varied widely depending upon location. For example, at the 780 kya Gesher Benot Ya'aqov site, Israel, the inhabitants gathered and ate 55 different types of fruits, vegetables, seeds, nuts, and tubers, and it appears that they used fire to roast certain plant materials that otherwise would have been inedible; they also consumed amphibians, reptiles, birds, aquatic and terrestrial invertebrates, in addition to the usual large creatures such as elephant and fallow deer.[120] At the 1.95 Mya FwJJ20 lakeside site in the East Turkana Basin, Kenya, the inhabitants ate (alongside the usual bovids, hippos, and rhinos) aquatic creatures such as turtles, crocodiles,

and catfish. The large animals were likely scavenged at this site, but the turtles and fish were possibly collected live.[121] In East Africa between 2.0 and 1.4 Mya, carcasses of C_4-grazing ungulates, particularly alcelaphins, featured increasingly prominently in the diet of these hominins.[122] At the 1.5 Mya Trinil H. K. site, Java, *H. erectus* likely gathered fish and shellfish.[123]

Dentally, *H. erectus* mouths were not as versatile as those of ancestor species, capable of processing a narrower range of foods. However, tools were likely used to process hard foods, thus affecting the chewing apparatus, and this combination may have instead increased dietary flexibility (though this does not equate to a highly varied diet). Such versatility may have permitted *H. erectus* to inhabit a range of different environments, and migrate beyond Africa.[88]

In 1999, British anthropologist Richard Wrangham proposed the "cooking hypothesis" which states that *H. erectus* speciated from the ancestral *H. habilis* because of fire usage and cooking 2 million years ago to explain the rapid doubling of brain size between these two species in only a 500,000 year timespan, and the sudden appearance of the typical human body plan. Cooking makes protein more easily digestible, speeds up nutrient absorption, and destroys food-borne pathogens, which would have increased the environment's natural carrying capacity, allowing group size to expand, causing selective pressure for sociality, requiring greater brain function.[124][125] However, the fossil record does not associate the emergence of *H. erectus* with fire usage nor with any technological breakthrough for that matter, and cooking likely did not become a common practice until after 400 kya.[88][113]

Java Man's dispersal through Southeast Asia coincides with the extirpation of the giant turtle *Megalochelys*, possibly due to overhunting as the turtle would have been an easy, slow-moving target which could have been stored for quite some time.[126]

Yorum

Büyüme, çocukların hızlı olması, bir an önce olgunlaşmaları ve doğa ile mücadelede başarılı olmaları açısından önemlidir. Bu türün doğaya uyumu olarak ele alınmalıdır.

Ateşi kullanmayı bilmelerine karşın, yemek yapmak için kullanmaları daha yenidir. Ateşi daha ziyade, gece yürümeye devam etmeleri, göç için kullanmaları önemli bir bulgu olmuştur.

Technology

Tool production

H. erectus is credited with inventing the Acheulean stone tool industry, succeeding the Oldowan industry,[127][128] and were the first to make lithic flakes bigger than 10 cm (3.9 in), and hand axes (which includes bifacial tools with only 2 sides, such as picks, knives, and cleavers).[129] Though larger and heavier, these hand axes had sharper, chiseled edges.[130] They were likely multi-purpose tools, used in variety of activities such as cutting meat, wood, or edible plants.[131] In 1979, American paleontologist Thomas Wynn stated that Acheulean technology required operational intelligence (foresight and planning), being markedly more complex than Oldowan technology which included lithics of unstandardized shape, cross-sections, and symmetry. Based on this, he concluded that there is not a significant disparity in intelligence between *H. erectus* and modern humans and that, for the last 300,000 years, increasing intelligence has not been a major influencer of cultural evolution.[132] However, a 1 year old *H. erectus* specimen shows that this species lacked an extended childhood required for greater brain development, indicating lower cognitive capabilities.[110] A few sites, likely due to occupation over several generations, features hand axes en masse, such as at Melka Kunture, Ethiopia; Olorgesailie, Kenya; Isimila, Tanzania; and Kalambo Falls, Zambia.[131]

The earliest record of Acheulean technology comes from West Turkana, Kenya 1.76 Mya. Oldowan lithics are also known from the site, and the two seemed to coexist for some time. The earliest records of Acheulean technology outside of Africa date to no older than 1 Mya, indicating it only became widespread after some secondary *H. erectus* dispersal from Africa.[130]

On Java, *H. erectus* produced tools from shells at Sangiran[133] and Trinil.[134] Spherical stones, measuring 6–12 cm (2.4–4.7 in) in diameter, are frequently found in African and Chinese Lower Paleolithic sites, and were potentially used as bolas; if correct, this would indicate string and cordage technology.[135]

Fire

H. erectus is credited as the first human ancestor to have used fire, though the timing of this invention is debated mainly because campfires very rarely and very poorly preserve over long periods of time, let alone thousands or millions of years. The earliest claimed fire sites are in Kenya, FxJj20 at Koobi Fora[136][124][137] and GnJi 1/6E in the Chemoigut Formation, as far back as 1.5 Mya,[124][137] and in South Africa, Wonderwerk Cave, 1.7

Mya.[138] The first firekeepers are thought to have simply transported to caves and maintained naturally occurring fires for extended periods of time or only sporadically when the opportunity arose. Maintaining fires would require firekeepers to have knowledge on slow-burning materials such as dung.[124] Fire becomes markedly more abundant in the wider archaeological record after 400,000–300,000 years ago, which can be explained as some advancement in fire management techniques took place at this time[124] or human ancestors only opportunistically used fire until this time.[137][139][88][113] It is possible that fire-starting was invented and lost and reinvented multiple times and independently by different communities rather than being invented in one place and spreading throughout the world.[139] The earliest evidence of hearths comes from Gesher Benot Ya'aqov, Israel, over 700,000 years ago, where fire is recorded in multiple layers in an area close to water, both uncharacteristic of natural fires.[125]

Artificial lighting may have led to increased waking hours—modern humans have about a 16-hour waking period, whereas other apes are generally awake from only sunup to sundown—and these additional hours were probably used for socializing. Because of this, fire usage is probably also linked to the origin of language.[124][125] Artificial lighting may have also made sleeping on the ground instead of the trees possible by keeping terrestrial predators at bay.[125]

Migration into the frigid climate of Ice Age Europe may have only been possible because of fire, but evidence of fire usage in Europe until about 400–300,000 years ago is notably absent.[137] If these early European *H. erectus* did not have fire, it is largely unclear how they stayed warm, avoided predators, and prepared animal fat and meat for consumption. There was also a lower likelihood of naturally occurring fires due to lightning being less common in areas further north. It is possible that they only knew how to maintain fires in certain settings in the landscapes and prepared food some distance away from home, meaning evidence of fire and evidence of hominin activity are spaced far apart.[125] Alternatively, *H. erectus* may have only pushed farther north during warmer interglacial periods—thus not requiring fire, food storage, or clothing technology—[140] and their dispersal patterns indicate they generally stayed in warmer lower-to-middle latitudes.[118] It is debated if the *H. e. pekinensis* inhabitants of Zhoukoudian, Northern China, were capable of controlling fires as early as 770 kya to stay warm in what may have been a relatively cold climate.[141]

Construction

In 1962, a 366 cm × 427 cm × 30 cm (12 ft × 14 ft × 1 ft) circle made with volcanic rocks was discovered in Olduvai Gorge. At 61–76 cm (2–2.5 ft) intervals, rocks were piled up to 15–23 cm (6–9 in) high. British palaeoanthropologist Mary Leakey suggested the rock piles were used to support poles stuck into the ground, possibly to support a windbreak or a rough hut. Some modern day nomadic tribes build similar low-lying rock walls to build temporary shelters upon, bending upright branches as poles and using grasses or animal hide as a screen.[143] Dating to 1.75 Mya, it is the oldest claimed evidence of architecture.[144]

In Europe, evidence of constructed dwelling structures dating to or following the Holstein Interglacial (which began 424 kya) has been claimed in Bilzingsleben, Germany; Terra Amata, France; and Fermanville and Saint-Germain-des-Vaux in Normandy. The oldest evidence of a dwelling (and a campfire) in Europe comes from Přezletice, Czech Republic, 700 kya during the Cromerian Interglacial. This dwelling's base measured about 3 m × 4 m (9.8 ft × 13.1 ft) on the exterior and 3 m × 2 m (9.8 ft × 6.6 ft) on the interior, and is considered to have been a firm surface hut, probably with a vaulted roof made of thick branches or thin poles, supported by a foundation of big rocks and earth, and likely functioned as a winter base camp.[145]

The earliest evidence of cave habitation is Wonderwerk Cave, South Africa, about 1.6 Mya, but evidence of cave use globally is sporadic until about 600 kya.[146]

Clothing

It is largely unclear when clothing was invented, with the earliest estimate stretching as far back as 3 Mya to compensate for a lack of insulating body hair.[103] It is known that head lice and body lice (the latter can only inhabit clothed individuals) for modern humans diverged about 170 kya, well before modern humans left Africa, meaning clothes were already well in use before encountering cold climates. One of the first uses of animal hide is thought to have been for clothing, and the oldest hide scrapers date to about 780 kya, though this is not indicative of clothing.[147]

Seafaring

Acheulean artifacts discovered on isolated islands that were never connected to land in the Pleistocene may show seafaring by *H. erectus* as early as 1 Mya in Indonesia. They had arrived on the islands of Flores, Timor, and Roti, which would have necessitated crossing the Lombok Strait (the Wallace Line), at least before 800 kya. It is also possible they were the first European mariners as well and crossed the Strait of Gibraltar between North Africa and Spain. A 2021 genetic analysis of these island populations of *H. erectus* found no evidence of interbreeding

with modern humans.[148] Seafaring capability would show *H. erectus* had a great capacity for planning, likely months in advance of the trip.[149][150]

Similarly, *Homo luzonensis* is dated between 771,000 and 631,000 years ago. Because Luzon has always been an island in the Quaternary, the ancestors of *H. luzonensis* would have had to have made a substantial sea crossing and crossed the Huxley Line.[151]

Healthcare

The earliest probable example of infirming sick group members is a 1.77 Mya *H. e. georgicus* specimen who had lost all but one tooth due to age or gum disease, the earliest example of severe chewing impairment, yet still survived for several years afterwards. However, it is possible australopithecines were capable of caring for debilitated group members.[152] Unable to chew, this *H. e. georgicus* individual probably ate soft plant or animal foods possibly with assistance from other group members. High-latitude groups are thought to have been predominantly carnivorous, eating soft tissue such as bone marrow or brains, which may have increased survival rates for toothless individuals.[153]

The 1.5 Mya Turkana boy was diagnosed with juvenile spinal disc herniation, and, because this specimen was still growing, this caused some scoliosis (abnormal curving of the spine). These usually cause recurrent lower back pain and sciatica (pain running down the leg), and likely restricted Turkana boy in walking, bending, and other daily activities. The specimen appears to have survived into adolescence, which evidences advanced group care.[154]

The 1,000–700 kya Java man specimen presents a noticeable osteocyte on the femur, likely Paget's disease of bone, and osteopetrosis, thickening of the bone, likely resulting from skeletal fluorosis caused by ingestion of food contaminated by fluorine-filled volcanic ash (as the specimen was found in ash-filled strata). Livestock that grazes on volcanic ash ridden fields typically die of acute intoxication within a few days or weeks.[155]

Art and rituals

An engraved Pseudodon shell DUB1006-fL with geometric markings could possibly be evidence of the earliest art-making, dating back to 546–436 kya. Art-making capabilities could be considered evidence of symbolic thinking, which is associated with modern cognition and behavior.[134][156][157][158] In 1976, American archeologist Alexander Marshack asserted that engraved lines on an ox rib, associated with Acheulean lithics, from Pech de l'Azé, France, are similar to a meander design found in modern human Upper Paleolithic cave art.[159] Three ostrich eggshell beads associated with Achuelian lithics were found in northwestern Africa, the earliest disc beads ever found, and Acheulian disc beads have also been found in France and Israel.[149] The Middle Pleistocene "Venus of Tan-Tan" and "Venus of Berekhat Ram" are postulated to been crafted by *H. erectus* to resemble a human form. They were mostly formed by natural weathering, but slightly modified to emphasize certain grooves to suggest hairline, limbs, and eyes.[160][161] The former has traces of pigments on the front side, possibly indicating it was colored.[160]

H. erectus was also the earliest human to have intentionally collected red-colored pigments, namely ochre, recorded as early as the Middle Pleistocene. Ochre lumps at Olduvai Gorge, Tanzania—associated with the 1.4 Ma Olduvai Hominid 9—and Ambrona, Spain—which dates to 424–374 kya—were suggested to have been struck by a hammerstone and purposefully shaped and trimmed.[162][159] At Terra Amata, France—which dates to 425–400 or 355–325 kya—red, yellow, and brown ochres were recovered in association with pole structures; ochre was probably heated to achieve such a wide color range.[162][163] As it is unclear if *H. erectus* could have used ochre for any practical application, ochre collection might indicate that *H. erectus* was the earliest human to have exhibited a sense of aesthetics and to think beyond simply survival. Later human species are postulated to have used ochre as body paint, but in the case of *H. erectus*, it is contested if body paint was used so early in time. Further, it is unclear if these few examples are not simply isolated incidents of ochre use, as ochre is much more prevalent in Middle and Upper Paleolithic sites attributed to Neanderthals and *H. sapiens*.[164][159]

In 1935, Jewish-German anthropologist Franz Weidenreich speculated that the inhabitants of the Chinese Zhoukoudian Peking Man site were members of some Lower Paleolithic Skull Cult because the skulls all showed fatal blows to the head, breaking in of the foramen magnum at the base of the skull, by-and-large lack of preserved facial aspects, an apparently consistent pattern of breaking on the mandible, and a lack of post-cranial remains (elements that are not the skull). He believed that the inhabitants were headhunters, and smashed open the skulls and ate the brains of their victims.[165][159] However, scavenging animals and natural forces such as flooding can also inflict the same kind of damage to skulls,[159] and there is not enough evidence to suggest manhunting or cannibalism.[166]

In 1999, British science writers Marek Kohn and Steven Mithen said that many hand axes exhibit no wear and were produced en masse, and concluded that these symmetrical, tear-drop shaped lithics functioned primarily

as display tools so males could prove their fitness to females in some courting ritual, and were discarded afterwards.[167] However, an apparent lack of reported wearing is likely due to a lack of use-wear studies, and only a few sites yield an exorbitant sum of hand axes likely due to gradual accumulation over generations instead of mass production.[131]

Language

In 1984, the vertebral column of the 1.6 Mya adolescent Turkana boy indicated that this individual did not have properly developed respiratory muscles in order to produce speech. In 2001, American anthropologists Bruce Latimer and James Ohman concluded that Turkana boy was afflicted by skeletal dysplasia and scoliosis.[168] In 2006, American anthropologist Marc Meyer and colleagues described a 1.8 Mya *H. e. georgicus* specimen as having a spine within the range of variation of modern human spines, contending that Turkana boy had spinal stenosis and was thus not representative of the species. Also, because he considered *H. e. georgicus* ancestral to all non-African *H. erectus*, Meyer concluded that the respiratory muscles of all *H. erectus* (at least non-*H. ergaster*) would not have impeded vocalization or speech production.[169] However, in 2013 and 2014, anthropologist Regula Schiess and colleagues concluded that there is no evidence of any congenital defects in Turkana boy, and considered the specimen representative of the species.[170][171]

Neurologically, all *Homo* have similarly configured brains, and, likewise, the Broca's and Wernicke's areas (in charge of sentence formulation and speech production in modern humans) of *H. erectus* were comparable to those of modern humans. However, this is not indicative of anything in terms of speech capability as even large chimpanzees can have similarly expanded Broca's area, and it is unclear if these areas served as language centers in archaic humans.[172] A 1-year-old *H. erectus* specimen shows that an extended childhood to allow for brain growth, which is a prerequisite in language acquisition, was not exhibited in this species.[110]

The hyoid bone supports the tongue and makes possible modulation of the vocal tract to control pitch and volume. A 400 kya *H. erectus* hyoid bone from Castel di Guido, Italy, is bar-shaped—more similar to that of other *Homo* than to that of non-human apes and *Australopithecus*—but is devoid of muscle impressions, has a shield-shaped body, and is implied to have had reduced greater horns, meaning *H. erectus* lacked a humanlike vocal apparatus and thus anatomical prerequisites for a modern human level of speech.[173] Increasing brain size and cultural complexity in tandem with technological refinement, and the hypothesis that articulate Neanderthals and modern humans may have inherited speech capabilities from the last common ancestor, could possibly indicate that *H. erectus* used some proto-language and built the basic framework which fully fledged languages would eventually be built around.[174] However, this ancestor may have instead been *H. heidelbergensis*, as a hyoid bone of a 530 kya *H. heidelbergensis* specimen from the Spanish Sima de los Huesos Cave is like that of modern humans,[175] and another specimen from the same area shows an auditory capacity sensitive enough to pick up human speech.[176]

Yorum

Modern insandan farklılıkları tanımlansa bile, onların farklı tür olduğu ama bize benzeyen yanları ile antropolojik yakınlık duymalıyız.

Köpek yetiştirenler bilir, çok farklı cins olması yanında, farklı davranışları ile her birinin ayrıcalıklı olması gözlenmiştir. Onlara bu nedenle adları ile yaklaşmalı, kişilikleri vardır, bu nedenle insan gibi davranmalıyız.

Her insan ayrı, özel ve özgündür, yapısal benzer olsa bile tümünü ayrı, kişilikleri ile irdelenmesi gerekir.

Extinction

The last known occurrence of *Homo erectus* is 117,000–108,000 years ago in Ngandong, Java according to a study published in 2019.[1]

In 2020 researchers reported that *Homo erectus* and *Homo heidelbergensis* lost more than half of their climate niche – climate they were adapted to – with no corresponding reduction in physical range, just before extinction and that climate change played a substantial role in extinctions of past *Homo* species.[177][178][179]

Yorum

Homo sapiens, sapiens görüldüğü, zamanda tükendikleri, ortadan kalktığı gözlenmektedir. İklim değişikliği, buna uyum sağlanmadığı bir neden olarak gösterilmiştir.

Dünyanın birçok yerine dağıldığına göre bu teori tam kabul edilmemelidir demekteyim.

İnsanların, Neandertal türünün ortadan kaldırılması da olanaklı olmamalıdır.

Fossils

The lower cave of China's Zhoukoudian Cave is one of the most important archaeological sites worldwide.[180] There have been remains of 45 *Homo erectus* individuals found and thousands of tools recovered.[180] Most of these remains were lost during World War 2, with the exception of two postcranial elements that were rediscovered in China in 1951 and four human teeth from 'Dragon Bone Hill'.[180]

New evidence has shown that *Homo erectus* does not have uniquely thick vault bones, as was previously thought.[181] Testing showed that neither Asian nor African *Homo erectus* had uniquely large vault bones.[181]

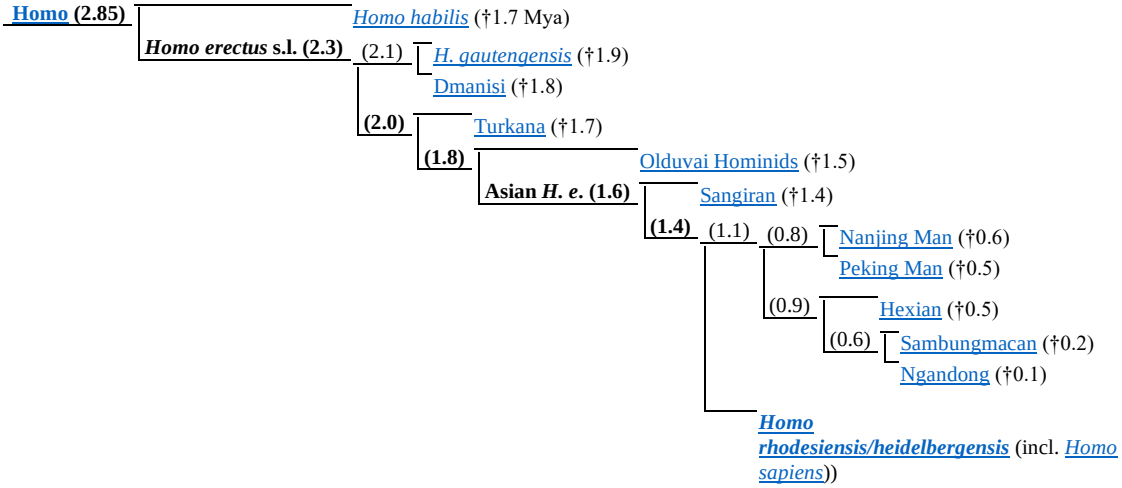
Individual fossils

Some of the major *Homo erectus* fossils:

- Indonesia (island of Java): Trinil 2 (holotype), Sangiran collection, Sambungmachan collection,[182] Ngandong collection
- China ("Peking Man"): Lantian (Gongwangling and Chenjiawo), Yunxian, Zhoukoudian, Nanjing, Hexian
- Kenya: KNM ER 3883, KNM ER 3733
- Vietnam: Northern, Tham Khuyen,[183] Hoa Binh[*citation needed*]
- Republic of Georgia: Dmanisi collection ("*Homo erectus georgicus*")
- Ethiopia: Daka calvaria
- Eritrea: Buia cranium (possibly *H. ergaster*)[184]
- Denizli Province, Turkey: Kocabas fossil[106]
- Drimolen, South Africa: DNH 134[185]

Phylogeny

A cladogram of *Homo erectus* is as follows.[186] It is indicated how many million years ago the clades diverged.



Homo erectus was originally African. The extant *Homo heidelbergensis* (cladistically granting *Homo sapiens*), which was originally African, emerged within the Asian *Homo erectus*. Contemporary groups appear to have been interbreeding, so any phylogeny like this only gives a coarse impression of the evolution of *Homo*, and extinct lineage may have partially continued in other groupings. Not included are other contemporary groups such as *Homo floresiensis*, *Homo naledi*, *Homo luzonensis*, *Homo rudolfensis*, *Australopithecus sediba*, *Australopithecus africanus*, *and Paranthropus*.

Yorum

Dünyanın birçok yerinde aynı Homo erectus farklı adlarla ve aynı türün alt elemanları olarak tanımlanmaktadır.

Önemli olan yapı değil, genetik boyuttur, bu açıdan aynı yapıda olmasalar bile, aynı türdürler.

Bu arada Neandertallere de bakarsak:

Neanderthal, Wikipedia[3]

Neanderthals (/niˈændərˌtɑːl, neɪ-, -ˌθɑːl/;[7] ***Homo neanderthalensis*** or ***H. sapiens neanderthalensis***), also written as **Neandertals**, are an extinct species or subspecies of archaic humans who lived in Eurasia until about 40,000 years ago.[8][9][10][11] The reasons for Neanderthal extinction are disputed.[12][13] Theories for their extinction include demographic factors such as small population size and inbreeding, competitive replacement,[14] interbreeding and assimilation with modern humans,[15] climate change,[16][17][18] disease,[19][20] or a combination of these factors.[18]

It is unclear when the line of Neanderthals split from that of modern humans; studies have produced various intervals ranging from 315,000[21] to more than 800,000 years ago.[22] The date of divergence of Neanderthals from their ancestor *H. heidelbergensis* is also unclear. The oldest potential Neanderthal bones date to 430,000 years ago, but the classification remains uncertain.[23] Neanderthals are known from numerous fossils, especially from after 130,000 years ago.[24] The type specimen, Neanderthal 1, was found in 1856 in the Neander Valley in present-day Germany. For much of the early 20th century, European researchers depicted Neanderthals as primitive, unintelligent, and brutish. Although knowledge and perception of them has markedly changed since then in the scientific community, the image of the unevolved caveman archetype remains prevalent in popular culture.[25][26]

Neanderthal technology was quite sophisticated. It includes the Mousterian stone-tool industry[27][28] and ability to create fire[29][30] and build cave hearths,[31][32] make adhesive birch bark tar,[33] craft at least simple clothes similar to blankets and ponchos,[34] weave,[35] go seafaring through the Mediterranean,[36][37] and make use of medicinal plants,[38][39][40] as well as treat severe injuries,[41] store food,[42] and use various cooking techniques such as roasting, boiling,[43] and smoking.[44] Neanderthals made use of a wide array of food, mainly hoofed mammals,[45] but also other megafauna,[25][46] plants,[47][48][49] small mammals, birds, and aquatic and marine resources.[50] Although they were probably apex predators, they still competed with cave bears, cave lions, cave hyenas, and other large predators.[51] A number of examples of symbolic thought and Palaeolithic art have been inconclusively[52] attributed to Neanderthals, namely possible ornaments made from bird claws and feathers[53][54] or shells,[55] collections of unusual objects including crystals and fossils,[56] engravings,[57] music production (possibly indicated by the Divje Babe flute),[58] and Spanish cave paintings contentiously[59] dated to before 65,000 years ago.[60][61] Some claims of religious beliefs have been made.[62] Neanderthals were likely capable of speech, possibly articulate, although the complexity of their language is not known.[63][64]

Compared with modern humans, Neanderthals had a more robust build and proportionally shorter limbs. Researchers often explain these features as adaptations to conserve heat in a cold climate, but they may also have been adaptations for sprinting in the warmer, forested landscape that Neanderthals often inhabited.[65] Nonetheless, they had cold-specific adaptations, such as specialised body-fat storage[66] and an enlarged nose to warm air[67] (although the nose could have been caused by genetic drift[68]). Average Neanderthal men stood around 165 cm (5 ft 5 in) and women 153 cm (5 ft 0 in) tall, similar to pre-industrial modern humans.[69] The braincases of Neanderthal men and women averaged about 1,600 cm^3 (98 cu in) and 1,300 cm^3 (79 cu in) respectively,[70][71][72] which is considerably larger than the modern human average.[73] The Neanderthal skull was more elongated and the brain had smaller parietal lobes[74][75][76] and cerebellum,[77][78] but larger temporal, occipital, and orbitofrontal regions.[79][80]

The total population of Neanderthals remained low, proliferating weakly harmful gene variants[81] and precluding effective long-distance networks. Despite this, there is evidence of regional cultures and thus of regular communication between communities.[82][83] They may have frequented caves and moved between them seasonally.[84] Neanderthals lived in a high-stress environment with high trauma rates, and about 80% died before the age of 40.[85] The 2010 Neanderthal genome project's draft report presented evidence for interbreeding between Neanderthals and modern humans.[86][87][88] It possibly occurred 316,000 to 219,000 years ago,[89] but more likely 100,000 years ago and again 65,000 years ago.[90] Neanderthals also appear to have interbred with Denisovans, a different group of archaic humans, in Siberia.[91][92] Around 1–4% of genomes of Eurasians, Indigenous Australians, Melanesians, Native Americans, and North Africans is of Neanderthal ancestry, while the inhabitants of sub-Saharan Africa have only 0.3% of Neanderthal genes, save possible traces from early sapiens-to-Neanderthal gene flow and/or more recent back-migration of Eurasians to Africa. In all, about 20% of distinctly Neanderthal gene variants survive today.[93] Although many of the gene variants inherited from Neanderthals may have been detrimental and selected out,[81] Neanderthal introgression appears to have affected the modern human immune system,[94][95][96][97] and is also implicated in several other biological functions and structures,[98] but a large portion appears to be non-coding DNA.[99]

Yorum

Avrupa'da, Almanya Düsseldorf tarafında ilk bulunması nedeniyle bu yerin adını almıştır. Homo erectus 'tan farklı genetik yapıdadır.

Taxonomy

Etymology

Neanderthals are named after the Neandertal Valley in which the first identified specimen was found. The valley was spelled *Neanderthal* and the species was spelled *Neanderthaler* in German until the spelling reform of 1901.[b] The spelling *Neandertal* for the species is occasionally seen in English, even in scientific publications, but the scientific name, *H. neanderthalensis*, is always spelled with *th* according to the principle of priority. The vernacular name of the species in German is always *Neandertaler* ("inhabitant of the Neander Valley"), whereas *Neandertal* always refers to the valley.[c] The valley itself was named after the late 17th century German theologian and hymn writer Joachim Neander, who often visited the area.[100] His name in turn means 'new man', being a learned Graecization of the German surname *Neumann*.

Neanderthal can be pronounced using the /t/ (as in /niˈændərtɑːl/)[103] or the standard English pronunciation of *th* with the fricative /θ/ (as /niˈændərθɔːl/).[104][105]

Neanderthal 1, the type specimen, was known as the "Neanderthal cranium" or "Neanderthal skull" in anthropological literature, and the individual reconstructed on the basis of the skull was occasionally called "the Neanderthal man".[106] The binomial name *Homo neanderthalensis*—extending the name "Neanderthal man" from the individual specimen to the entire species, and formally recognising it as distinct from humans—was first proposed by Irish geologist William King in a paper read to the 33rd British Science Association in 1863.[107][108][109] However, in 1864, he recommended that Neanderthals and modern humans be classified in different genera as he compared the Neanderthal braincase to that of a chimpanzee and argued that they were "incapable of moral and [theistic[d]] conceptions".[110]

Research history

The first Neanderthal remains—Engis 2 (a skull)—were discovered in 1829 by Dutch/Belgian prehistorian Philippe-Charles Schmerling in the Grottes d'Engis, Belgium. He concluded that these "poorly developed" human remains must have been buried at the same time and by the same causes as the co-existing remains of extinct animal species.[111] In 1848, Gibraltar 1 from Forbes' Quarry was presented to the Gibraltar Scientific Society by their Secretary Lieutenant Edmund Henry Réné Flint, but was thought to be a modern human skull.[112] In 1856, local schoolteacher Johann Carl Fuhlrott recognised bones from Kleine Feldhofer Grotte in Neander Valley—Neanderthal 1 (the holotype specimen)—as distinct from modern humans,[e] and gave them to German anthropologist Hermann Schaaffhausen to study in 1857. It comprised the cranium, thigh bones, right arm, left humerus and ulna, left ilium (hip bone), part of the right shoulder blade, and pieces of the ribs.[110][113] Following Charles Darwin's *On the Origin of Species*, Fuhlrott and Schaaffhausen argued the bones represented an ancient modern human form;[26][110][114][115] Schaaffhausen, a social Darwinist, believed that humans linearly progressed from savage to civilised, and so concluded that Neanderthals were barbarous cave-dwellers.[26] Fuhlrott and Schaaffhausen met opposition namely from the prolific pathologist Rudolf Virchow who argued against defining new species based on only a single find. In 1872, Virchow erroneously interpreted Neanderthal characteristics as evidence of senility, disease, and malformation instead of archaicness,[116] which stalled Neanderthal research until the end of the century.[26][114]

By the early 20th century, numerous other Neanderthal discoveries were made, establishing *H. neanderthalensis* as a legitimate species. The most influential specimen was La Chapelle-aux-Saints 1 ("The Old Man") from La Chapelle-aux-Saints, France. French palaeontologist Marcellin Boule authored several publications, among the first to establish palaeontology as a science, detailing the specimen, but reconstructed him as slouching, ape-like, and only remotely related to modern humans. The 1912 'discovery' of Piltdown Man (a hoax), appearing much more similar to modern humans than Neanderthals, was used as evidence that multiple different and unrelated branches of primitive humans existed, and supported Boule's reconstruction of *H. neanderthalensis* as a far distant relative and an evolutionary dead-end.[26][117][118][119] He fuelled the popular image of Neanderthals as barbarous, slouching, club-wielding primitives; this image was reproduced for several decades and popularised in science fiction works, such as the 1911 *The Quest for Fire* by J.-H. Rosny aîné and the 1927 *The Grisly Folk* by H. G. Wells where they are depicted as monsters.[26] In 1911, Scottish anthropologist Arthur Keith reconstructed La Chapelle-aux-Saints 1 as an immediate precursor to modern humans, sitting next to a fire, producing tools, wearing a necklace, and having a more humanlike posture, but this failed to garner much scientific rapport, and Keith later abandoned his thesis in 1915.[26][114][120]

By the middle of the century, based on the exposure of Piltdown Man as a hoax as well as a reexamination of La Chapelle-aux-Saints 1 (who had osteoarthritis which caused slouching in life) and new discoveries, the scientific community began to rework its understanding of Neanderthals. Ideas such as Neanderthal behaviour, intelligence, and culture were being discussed, and a more humanlike image of them emerged. In 1939, American anthropologist Carleton Coon reconstructed a Neanderthal in a modern business suit and hat to emphasise that they would be, more or less, indistinguishable from modern humans had they survived into the present. William Golding's 1955 novel *The Inheritors* depicts Neanderthals as much more emotional and civilised.[26][25][119] However, Boule's image continued to influence works until the 1960s. In modern-day, Neanderthal reconstructions are often very humanlike.[114][119]

Hybridisation between Neanderthals and early modern humans had been suggested early on,[121] such as by English anthropologist Thomas Huxley in 1890,[122] Danish ethnographer Hans Peder Steensby in 1907,[123] and Coon in 1962.[124] In the early 2000s, supposed hybrid specimens were discovered: Lagar Velho 1[125][126][127][128] and Muierii 1.[129] However, similar anatomy could also have been caused by adapting to a similar environment rather than interbreeding.[99] Neanderthal admixture was found to be present in modern populations in 2010 with the mapping of the first Neanderthal genome sequence.[86] This was based on three specimens in Vindija Cave, Croatia, which contained almost 4% archaic DNA (allowing for near complete sequencing of the genome). However, there was approximately 1 error for every 200 letters (base pairs) based on the implausibly high mutation rate, probably due to the preservation of the sample. In 2012, British-American geneticist Graham Coop hypothesised that they instead found evidence of a different archaic human species interbreeding with modern humans, which was disproven in 2013 by the sequencing of a high-quality Neanderthal genome preserved in a toe bone from Denisova Cave, Siberia.[99]

Classification

Neanderthals are hominids in the genus *Homo*, humans, and generally classified as a distinct species, *H. neanderthalensis*, although sometimes as a subspecies of modern human as *H. sapiens neanderthalensis*. This would necessitate the classification of modern humans as *H. sapiens sapiens*.[131]

A large part of the controversy stems from the vagueness of the term "species", as it is generally used to distinguish two genetically isolated populations, but admixture between modern humans and Neanderthals is known to have occurred.[131][132] However, the absence of Neanderthal-derived patrilineal Y-chromosome and matrilineal mitochondrial DNA (mtDNA) in modern humans, along with the underrepresentation of Neanderthal X chromosome DNA, could imply reduce fertility or frequent sterility of some hybrid crosses,[88][133][134][135] representing a partial biological reproductive barrier between the groups, and therefore species distinction.[88] In 2014 geneticist Svante Pääbo summarised the controversy, describing such "taxonomic wars" as unresolvable, "since there is no definition of species perfectly describing the case".[131]

Neanderthals are thought to have been more closely related to Denisovans than to modern humans. Likewise, Neanderthals and Denisovans share a more recent last common ancestor (LCA) than to modern humans, based on nuclear DNA (nDNA). However, Neanderthals and modern humans share a more recent mitochondrial LCA (observable by studying mtDNA). This likely resulted from an interbreeding event subsequent to the Neanderthal/Denisovan split which introduced another mtDNA line. This involved either introgression coming from an unknown archaic human into Denisovans,[91][92][130][136][137] or introgression from an earlier unidentified modern human wave from Africa into Neanderthals.[138]

Evolution

It is largely thought that *H. heidelbergensis* was the last common ancestor of Neanderthals, Denisovans, and modern humans before populations became isolated in Europe, Asia, and Africa, respectively.[140] The taxonomic distinction between *H. heidelbergensis* and Neanderthals is mostly based on a fossil gap in Europe between 300 and 243 thousand years ago during marine isotope stage 8. "Neanderthals", by convention, are fossils which date to after this gap.[139][25][21] However, 430,000-year old bones at Sima de los Huesos could represent early Neanderthals or a closely related group,[23][141][142] and the 400,000-year old Aroeira 3 could represent a transitional phase. Ancestral and derived morphs could have lived concurrently.[143] It is also possible that there was gene flow between Western Europe and Africa during the Middle Pleistocene, obscuring Neanderthal characteristics in such specimens, namely from Ceprano, Italy, and Sićevo Gorge, Serbia.[23] The fossil record is much more complete from 130,000 years ago onwards,[144] and specimens from this period make up the bulk of known Neanderthal skeletons.[145][146] Dental remains from the Italian Visogliano and Fontana Ranuccio sites indicate that Neanderthal dental features had evolved by around 450–430 thousand years ago during the Middle Pleistocene.[147]

There are two main hypotheses regarding the evolution of Neanderthals following the Neanderthal/human split: two-phase and accretion. Two-phase argues that a single major environmental event—such as the Saale glaciation—caused European *H. heidelbergensis* to increase rapidly in body size and robustness, as well as undergoing a lengthening of

the head (phase 1), which then led to other changes in skull anatomy (phase 2).[127] However, Neanderthal anatomy may not have been driven entirely by adapting to cold weather.[65] Accretion holds that Neanderthals slowly evolved over time from the ancestral *H. heidelbergensis*, divided into four stages: early-pre-Neanderthals (MIS 12, Elster glaciation), pre-Neanderthals *sensu lato* (MIS 11–9, Holstein interglacial), early Neanderthals (MIS 7–5, Saale glaciation–Eemian), and classic Neanderthals *sensu stricto* (MIS 4–3, Würm glaciation).[139]

Neandertal ile Homo sapiens, sapiens farklı türdedir

Şekil 3: Neandertal yapı üç farklı şekilde dağılım gösterdiği anlaşılmaktadır.

Numerous dates for the Neanderthal/human split have been suggested. The date of around 250,000 years ago cites "*H. helmei*" as being the last common ancestor (LCA), and the split is associated with the Levallois technique of making stone tools. The date of about 400,000 years ago uses *H. heidelbergensis* as the LCA. Estimates of 600,000 years ago assume that "*H. rhodesiensis*" was the LCA, which split off into modern human lineage and a Neanderthal/*H. heidelbergensis* lineage.[148] 800,000 years ago has *H. antecessor* as the LCA, but different variations of this model would push the date back to 1 million years ago.[23][148] However, a 2020 analysis of *H. antecessor* enamel proteomes suggests that *H. antecessor* is related but not a direct ancestor.[149] DNA studies have yielded various results for the Neanderthal/human divergence time, such as 538–315,[21] 553–321,[150] 565–503,[151] 654–475,[148] 690–550,[152] 765–550,[23][91] 741–317,[153] and 800–520 thousand years ago;[154] and a dental analysis concluded before 800,000 years ago.[22]
Neanderthals and Denisovans are more closely related to each other than they are to modern humans, meaning the Neanderthal/Denisovan split occurred after their split with modern humans.[23][91][136][155] Assuming a mutation rate of 1×10^{-9} or 0.5×10^{-9} per base pair (bp) per year, the Neanderthal/Denisovan split occurred around either 236–190 or 473–381 thousand years ago respectively.[91] Using 1.1×10^{-8} per generation with a new generation every 29 years, the time is 744,000 years ago. Using 5×10^{-10} nucleotide sites per year, it is 616,000 years ago. Using the latter dates, the split had likely already occurred by the time hominins spread out across Europe, and unique Neanderthal features had begun evolving by 600–500 thousand years ago.[136] Before splitting, Neanderthal/Denisovans (or "Neandersovans") migrating out of Africa into Europe apparently interbred with an unidentified "superarchaic" human species who were already present there; these superarchaics were the descendants of a very early migration out of Africa around 1.9 mya.[156]

Yorum

Homo sapiens, sapiens bakınca 300-200 bin yıl önce ilk genetik tanımlanırken, Homo erectus, milyon yıl önce, Neandertal de 500bin yıl önce olması da farklılığı ortaya koymaktadır.
Aynı dönemde birliktelik ve genetik olarak türlerin çiftleşmesi iddiası da olduğu bilinmelidir.
Ama Homo sapiens, sapiens ile gen karışması izi bulunmamıştır.

Demographics

Range

Pre- and early Neanderthals, living before the Eemian interglacial (130,000 years ago), are poorly known and come mostly from Western European sites. From 130,000 years ago onwards, the quality of the fossil record increases dramatically with classic Neanderthals, who are recorded from Western, Central, Eastern, and Mediterranean Europe,[24] as well as Southwest, Central, and Northern Asia up to the Altai Mountains in southern Siberia. Pre- and

early Neanderthals, on the other hand, seem to have continuously occupied only France, Spain, and Italy, although some appear to have moved out of this "core-area" to form temporary settlements eastward (although without leaving Europe). Nonetheless, southwestern France has the highest density of sites for pre-, early, and classic Neanderthals.[157] The southernmost find was recorded at Shuqba Cave, Levant;[158] reports of Neanderthals from the North African Jebel Irhoud[159] and Haua Fteah[160] have been reidentified as *H. sapiens*. Their easternmost presence is recorded at Denisova Cave, Siberia 85°E; the southeast Chinese Maba Man, a skull, shares several physical attributes with Neanderthals, although these may be the result of convergent evolution rather than Neanderthals extending their range to the Pacific Ocean.[161] The northernmost bound is generally accepted to have been 55°N, with unambiguous sites known between 50–53°N, although this is difficult to assess because glacial advances destroy most human remains, and palaeoanthropologist Trine Kellberg Nielsen has argued that a lack of evidence of Southern Scandinavian occupation is (at least during the Eemian interglacial) due to the former explanation and a lack of research in the area.[162][163] Middle Palaeolithic artefacts have been found up to 60°N on the Russian plains,[164][165][166] but these are more likely attributed to modern humans.[167] A 2017 study claimed the presence of *Homo* at the 130,000 year old Californian Cerutti Mastodon site in North America,[168] but this is largely considered implausible.[169][170][171]

It is unknown how the rapidly fluctuating climate of the last glacial period (Dansgaard–Oeschger events) impacted Neanderthals, as warming periods would produce more favourable temperatures but encourage forest growth and deter megafauna, whereas frigid periods would produce the opposite.[172] However, Neanderthals may have preferred a forested landscape.[65] Populations may have peaked in cold but not extreme intervals, such as marine isotope stages 8 and 6 (respectively 300 and 191 thousand years ago during the Saale glaciation). It is possible their range expanded and contracted as the ice retreated and grew respectively to avoid permafrost areas, residing in certain refuge zones during glacial maxima.[172] In 2021, Israeli anthropologist Israel Hershkovitz and colleagues suggested the 140 to 120 thousand years old Israeli Nesher Ramla remains, which feature a mix of Neanderthal and more ancient *H. erectus* traits, represent one such source population which recolonised Europe following a glacial period.[173]

Population

Like modern humans, Neanderthals probably descended from a very small population with an effective population—the number of individuals who can bear or father children—of 3,000 to 12,000 approximately. However, Neanderthals maintained this very low population, proliferating weakly harmful genes due to the reduced effectivity of natural selection.[81][174] Various studies, using mtDNA analysis, yield varying effective populations,[172] such as about 1,000 to 5,000;[174] 5,000 to 9,000 remaining constant;[175] or 3,000 to 25,000 steadily increasing until 52,000 years ago before declining until extinction.[83] Archaeological evidence suggests that there was a tenfold increase in the modern human population in Western Europe during the period of the Neanderthal/modern human transition,[176] and Neanderthals may have been at a demographic disadvantage due to a lower fertility rate, a higher infant mortality rate, or a combination of the two.[177] Estimates giving a total population in the higher tens of thousands[136] are contested.[174] A consistently low population may be explained in the context of the "Boserupian Trap": a population's carrying capacity is limited by the amount of food it can obtain, which in turn is limited by its technology. Innovation increases with population, but if the population is too low, innovation will not occur very rapidly and the population will remain low. This is consistent with the apparent 150,000-year stagnation in Neanderthal lithic technology.[172]

In a sample of 206 Neanderthals, based on the abundance of young and mature adults in comparison to other age demographics, about 80% of them above the age of 20 died before reaching 40. This high mortality rate was probably due to their high-stress environment.[85] However, it has also been estimated that the age pyramids for Neanderthals and contemporary modern humans were the same.[172] Infant mortality was estimated to have been very high for Neanderthals, about 43% in northern Eurasia.[178]

Yorum

Neandertallerin üreme kapasitesi modern insana göre10 kat az olması ve %80 kişinin 20 yaşlarında ölmezi, yüksek bebek ölümleri ile türlerinde yayılma az olmuştur. Küçük gruplar, aileler şeklinde olması da akraba evlilikleri ile anomali sıklığını göstermektedir. 10-30 kişilik gruplar halinde yaşamaktadırlar.

Beyin hacimleri modern insandan daha fazladır. Zekâ konusunda insan ile bir tartışma olmadığı gözlenmiştir.

%79-94 kazalardan mustarip olmalarıdır.

Neandertal ile insan geni arasında geçiş olduğu, karışım olduğu iddia edilmekte ise de bu türün insan değil, Neandertal türünün bir farklı yapısı olduğu iddia edenler de vardır.

Anatomy

Build

Neanderthals had more robust and stockier builds than typical modern humans,[69] wider and barrel-shaped rib cages; wider pelvises;[25][179] and proportionally shorter forearms and forelegs.[65][180]

Based on 45 Neanderthal long bones from 14 men and 7 women, the average height was 164 to 168 cm (5 ft 5 in to 5 ft 6 in) for males and 152 to 156 cm (5 ft 0 in to 5 ft 1 in) for females.[69] For comparison, the average height of 20 males and 10 females Upper Palaeolithic humans is respectively 176.2 cm (5 ft 9.4 in) and 162.9 cm (5 ft 4.1 in), although this decreases by 10 cm (4 in) nearer the end of the period based on 21 males and 15 females;[181] and the average in the year 1900 was 163 cm (5 ft 4 in) and 152.7 cm (5 ft 0 in), respectively.[182] The fossil record shows that adult Neanderthals varied from about 147.5 to 177 cm (4 ft 10 in to 5 ft 10 in) in height, although some may have grown much taller (73.8 to 184.8 cm based on footprint length and from 65.8 to 189.3 cm based on footprint width).[183] For Neanderthal weight, samples of 26 specimens found an average of 77.6 kg (171 lb.) for males and 66.4 kg (146 lb.) for females.[184] Using 76 kg (168 lb.), the body mass index for Neanderthal males was calculated to be 26.9–28.2, which in modern humans correlates to being overweight. This indicates a very robust build.[69] The Neanderthal LEPR gene concerned with storing fat and body heat production is similar to that of the woolly mammoth, and so was likely an adaptation for cold climate.[66]

The neck vertebrae of Neanderthals are thicker from the front to the rear and transversely than those of (most) modern humans, leading to stability, possibly to accommodate a different head shape and size.[185] Although the Neanderthal thorax (where the ribcage is) was similar in size to modern humans, the longer and straighter ribs would have equated to a widened mid-lower thorax and stronger breathing in the lower thorax, which are indicative of a larger diaphragm and possibly greater lung capacity.[179][186][187] The lung capacity of Kebara 2 was estimated to have been 9.04 L (2.39 US gal), compared to the average human capacity of 6 L (1.6 US gal) for males and 4.7 L (1.2 US gal) for females. The Neanderthal chest was also more pronounced (expanded front-to-back, or antero-posteriorly). The sacrum (where the pelvis connects to the spine) was more vertically inclined, and was placed lower in relation to the pelvis, causing the spine to be less curved (exhibit less lordosis) and to fold in on itself somewhat (to be invaginated). In modern populations, this condition affects just a proportion of the population, and is known as a lumbarized sacrum.[188] Such modifications to the spine would have enhanced side-to-side (mediolateral) flexion, better supporting the wider lower thorax. It is claimed by some that this feature would be normal for all *Homo*, even tropically-adapted *Homo ergaster* or *erectus*, with the condition of a narrower thorax in most modern humans being a unique characteristic.[179]

Body proportions are usually cited as being "hyperarctic" as adaptations to the cold, because they are similar to those of human populations which developed in cold climates[189]—the Neanderthal build is most similar to that of Inuit and Siberian Yupiks among modern humans[190]—and shorter limbs result in higher retention of body heat.[180][189][191] Nonetheless, Neanderthals from more temperate climates—such as Iberia—still retain the "hyperarctic" physique.[192] In 2019, English anthropologist John Stewart and colleagues suggested Neanderthals instead were adapted for sprinting, because of evidence of Neanderthals preferring more warmer wooded areas over the colder mammoth steppe, and DNA analysis indicating a higher proportion of fast-twitch muscle fibres in Neanderthals than in modern humans. He explained their body proportions and greater muscle mass as adaptations to sprinting as opposed to the endurance-oriented modern human physique,[65] as persistence hunting may only be effective in hot climates where the hunter can run prey to the point of heat exhaustion (hyperthermia). They had longer heel bones,[193] reducing their ability for endurance running, and their shorter limbs would have reduced moment arm at the limbs, allowing for greater net rotational force at the wrists and ankles, causing faster acceleration.[65] In 1981, American palaeoanthropologist Erik Trinkaus made note of this alternate explanation, but considered it less likely.[180][194]

Face

Neanderthals had less developed chins, sloping foreheads, and longer, broader, more projecting noses. The Neanderthal skull is typically more elongated, but also wider, and less globular than that of most modern humans, and features much more of an occipital bun,[195] or "chignon", a protrusion on the back of the skull, although it is within the range of variation for humans who have it. It is caused by the cranial base and temporal bones being placed higher and more towards the front of the skull, and a flatter skullcap.[196]

The Neanderthal face is characterized by mid-facial prognathism, where the zygomatic arches are positioned in a rearward location relative to modern humans, while their maxillary bones and nasal bones are positioned in a more forward direction, by comparison.[197] Neanderthal eyeballs are larger than those of modern humans. One study proposed that this was due to Neanderthals having enhanced visual abilities, at the expense of neocortical and social

development.[198] However this study was rejected by other researchers who concluded that eyeball size does not offer any evidence the cognitive abilities of Neanderthal or modern humans.[199]

The projected Neanderthal nose and paranasal sinuses have generally been explained as having warmed air as it entered the lungs and retained moisture ("nasal radiator" hypothesis);[200] if their noses were wider, it would differ to the generally narrowed shape in cold-adapted creatures, and that it would have been caused instead by genetic drift. Also, the sinuses reconstructed wide are not grossly large, being comparable in size to those of modern humans. However, if sinus size is not an important factor for breathing cold air, then the actual function would be unclear, so they may not be a good indicator of evolutionary pressures to evolve such a nose.[201] Further, a computer reconstruction of the Neanderthal nose and predicted soft tissue patterns shows some similarities to those of modern Arctic peoples, potentially meaning the noses of both populations convergently evolved for breathing cold, dry air.[67]

Neanderthals featured a rather large jaw which was once cited as a response to a large bite force evidenced by heavy wearing of Neanderthal front teeth (the "anterior dental loading" hypothesis), but similar wearing trends are seen in contemporary humans. It could also have evolved to fit larger teeth in the jaw, which would better resist wear and abrasion,[200][202] and the increased wear on the front teeth compared to the back teeth probably stems from repetitive use. Neanderthal dental wear patterns are most similar to those of modern Inuit.[200] The incisors are large and shovel-shaped, and, compared to modern humans, there was an unusually high frequency of taurodontism, a condition where the molars are bulkier due to an enlarged pulp (tooth core). Taurodontism was once thought to have been a distinguishing characteristic of Neanderthals which lent some mechanical advantage or stemmed from repetitive use, but was more likely simply a product of genetic drift.[203] The bite force of Neanderthals and modern humans is now thought to be about the same,[200] about 285 N (64 lbf) and 255 N (57 lbf) in modern human males and females, respectively.[204]

Brain

The Neanderthal braincase averages 1,640 cc for males and 1,460 cc for females,[71][72] which is significantly larger than the averages for all groups of extant humans;[73] for example, modern European males average 1,362 cm^3 (83.1 cu in) and females 1,201 cm^3 (73.3 cu in).[205] For 28 modern human specimens from 190 to 25 thousand years ago, the average was about 1,478 cm^3 (90.2 cu in) disregarding sex, and modern human brain size is suggested to have decreased since the Upper Palaeolithic.[206] The largest Neanderthal brain, Amud 1, was calculated to be 1,736 cm^3 (105.9 cu in), one of the largest ever recorded in hominids.[72] Both Neanderthal and human infants measure about 400 cm^3 (24 cu in).[207]

When viewed from the rear, the Neanderthal braincase has lower, wider, rounder appearance than in anatomically modern humans. This characteristic shape is referred to as "en bombe" (bomb-like), and is unique to Neanderthals, with all other hominid species (including most modern humans) generally having narrow and relatively upright cranial vaults, when viewed from behind.[208][209][210][211] The Neanderthal brain would have been characterized by relatively smaller parietal lobes[79] and a larger cerebellum.[79][212] Neanderthal brains also have larger occipital lobes (relating to the classic occurrence of an occipital bun in Neanderthal skull anatomy, as well as the greater width of their skulls), which implies internal differences in the proportionality of brain-internal regions, relative to *Homo sapiens*, consistent with external measurements obtained with fossil skulls.[198][213] Their brains also have larger temporal lobe poles,[212] wider orbitofrontal cortex,[214] and larger olfactory bulbs,[215] suggesting potential differences in language comprehension and associations with emotions (temporal functions), decision making (the orbitofrontal cortex), and sense of smell (olfactory bulbs). Their brains also show different rates of brain growth and development.[216] Such differences, while slight, would have been visible to natural selection and may underlie and explain differences in the material record in things like social behaviors, technological innovation, and artistic output.[14][217]

Hair and skin colour

The lack of sunlight most likely led to the proliferation of lighter skin in Neanderthals,[218] although it has been recently claimed that light skin in modern Europeans was not particularly prolific until perhaps the Bronze Age.[219] Genetically, BNC2 was present in Neanderthals, which is associated with light skin colour; however, a second variation of BNC2 was also present, which in modern populations is associated with darker skin colour in the UK Biobank.[218] DNA analysis of three Neanderthal females from southeastern Europe indicates that they had brown eyes, dark skin color, and brown hair; with one having red hair.[220][221]

In modern humans, skin and hair colour is regulated by the melanocyte-stimulating hormone—which increases the proportion of eumelanin (black pigment) to phaeomelanin (red pigment)—which is encoded by the MC1R gene. There are five known variants in modern humans of the gene which cause loss-of-function and are associated with light skin and hair colour, and another unknown variant in Neanderthals (the R307G variant) which could be associated with pale skin and red hair. The R307G variant was identified in a Neanderthal from Monti Lessini, Italy, and possibly

Cueva del Sidrón, Spain.[222] However, as in modern humans, red was probably not a very common hair colour because the variant is not present in many other sequenced Neanderthals.[218]

Metabolism

Maximum natural lifespan and the timing of adulthood, menopause, and gestation were most likely very similar to modern humans.[172] However, it has been hypothesised, based on the growth rates of teeth and tooth enamel,[223][224] that Neanderthals matured faster than modern humans, although this is not backed up by age biomarkers.[85] The main differences in maturation are the atlas bone in the neck as well as the middle thoracic vertebrae fused about 2 years later in Neanderthals than in modern humans, but this was more likely caused by a difference in anatomy rather than growth rate.[225][226]

Generally, models on Neanderthal caloric requirements report significantly higher intakes than those of modern humans because they typically assume Neanderthals had higher basal metabolic rates (BMRs) due to higher muscle mass, faster growth rate, and greater body heat production against the cold;[227][228][229] and higher daily physical activity levels (PALs) due to greater daily travelling distances while foraging.[228][229] However, using a high BMR and PAL, American archaeologist Bryan Hockett estimated that a pregnant Neanderthal would have consumed 5,500 calories per day, which would have necessitated a heavy reliance on big game meat; such a diet would have caused numerous deficiencies or nutrient poisonings, so he concluded that these are poorly warranted assumptions to make.[229]

Neanderthals may have been more active during dimmer light conditions rather than broad daylight because they lived in regions with reduced daytime hours in the winter, hunted large game (such predators typically hunt at night to enhance ambush tactics), and had large eyes and visual processing neural centres. Genetically, colour blindness (which may enhance mesopic vision) is typically correlated with northern-latitude populations, and the Neanderthals from Vindija Cave, Croatia, had some substitutions in the Opsin genes which could have influenced colour vision. However, the functional implications of these substitutions are inconclusive.[230] Neanderthal-derived alleles near ASB1 and EXOC6 are associated with being an evening person, narcolepsy, and day-time napping.[218]

Pathology

Neanderthals suffered a high rate of traumatic injury, with an estimated 79–94% of specimens showing evidence of healed major trauma, of which 37–52% were severely injured, and 13–19% injured before reaching adulthood.[231] One extreme example is Shanidar 1, who shows signs of an amputation of the right arm likely due to a nonunion after breaking a bone in adolescence, osteomyelitis (a bone infection) on the left clavicle, an abnormal gait, vision problems in the left eye, and possible hearing loss[232] (perhaps swimmer's ear).[233] In 1995, Trinkaus estimated that about 80% succumbed to their injuries and died before reaching 40, and thus theorised that Neanderthals employed a risky hunting strategy ("rodeo rider" hypothesis).[85] However, rates of cranial trauma are not significantly different between Neanderthals and Middle Palaeolithic modern humans (although Neanderthals seem to have had a higher mortality risk),[234] there are few specimens of both Upper Palaeolithic modern humans and Neanderthals who died after the age of 40,[177] and there are overall similar injury patterns between them. In 2012, Trinkaus concluded that Neanderthals instead injured themselves in the same way as contemporary humans, such as by interpersonal violence.[235] A 2016 study looking at 124 Neanderthal specimens argued that high trauma rates were instead caused by animal attacks, and found that about 36% of the sample were victims of bear attacks, 21% big cat attacks, and 17% wolf attacks (totalling 92 positive cases, 74%). There were no cases of hyena attacks, although hyenas still nonetheless probably attacked Neanderthals, at least opportunistically.[236] Such intense predation probably stemmed from common confrontations due to competition over food and cave space, and from Neanderthals hunting these carnivores.[236]

Low population caused a low genetic diversity and probably inbreeding, which reduced the population's ability to filter out harmful mutations (inbreeding depression). However, it is unknown how this affected a single Neanderthal's genetic burden and, thus, if this caused a higher rate of birth defects than in modern humans.[237] It is known, however, that the 13 inhabitants of Sidrón Cave collectively exhibited 17 different birth defects likely due to inbreeding or recessive disorders.[238] Likely due to advanced age (60s or 70s), La Chapelle-aux-Saints 1 had signs of Baastrup's disease, affecting the spine, and osteoarthritis.[239] Shanidar 1, who likely died at about 30 or 40, was diagnosed with the most ancient case of diffuse idiopathic skeletal hyperostosis (DISH), a degenerative disease which can restrict movement, which, if correct, would indicate a moderately high incident rate for older Neanderthals.[240]

Neanderthals were subject to several infectious diseases and parasites. Modern humans likely transmitted diseases to them; one possible candidate is the stomach bacteria *Helicobacter pylori*.[241] The modern human papillomavirus variant 16A may descend from Neanderthal introgression.[242] A Neanderthal at Cueva del Sidrón, Spain, shows evidence of a gastrointestinal *Enterocytozoon bieneusi* infection.[243] The leg bones of the French La Ferrassie 1 feature lesions that are consistent with periostitis—inflammation of the tissue enveloping the bone—likely a result of hypertrophic osteoarthropathy, which is primarily caused by a chest infection or lung

cancer.[244] Neanderthals had a lower cavity rate than modern humans, despite some populations consuming typically cavity-causing foods in great quantity, which could indicate a lack of cavity-causing oral bacteria, namely *Streptococcus mutans*.[245]

Two 250,000-year-old Neanderthaloid children from Payré, France, present the earliest known cases of lead exposure of any hominin. They were exposed on two distinct occasions either by eating or drinking contaminated food or water, or inhaling lead-laced smoke from a fire. There are two lead mines within 25 km (16 mi) of the site.[246]

Culture

Social structure

Group dynamics

Neanderthals likely lived in more sparsely distributed groups than contemporary modern humans,[172] but group size is thought to have averaged 10 to 30 individuals, similar to modern hunter-gatherers.[31] Reliable evidence of Neanderthal group composition comes from Cueva del Sidrón, Spain, and the footprints at Le Rozel, France:[183] the former shows 7 adults, 3 adolescents, 2 juveniles, and an infant;[247] whereas the latter, based on footprint size, shows a group of 10 to 13 members where juveniles and adolescents made up 90%.[183]

A Neanderthal child's teeth analysed in 2018 showed it was weaned after 2.5 years, similar to modern hunter gatherers, and was born in the spring, which is consistent with modern humans and other mammals whose birth cycles coincide with environmental cycles.[246] Indicated from various ailments resulting from high stress at a low age, such as stunted growth, British archaeologist Paul Pettitt hypothesised that children of both sexes were put to work directly after weaning;[178] and Trinkaus said that, upon reaching adolescence, an individual may have been expected to join in hunting large and dangerous game.[85] However, the bone trauma is comparable to modern Inuit, which could suggest a similar childhood between Neanderthals and contemporary modern humans.[248] Further, such stunting may have also resulted from harsh winters and bouts of low food resources.[246]

Sites showing evidence of no more than three individuals may have represented nuclear families or temporary camping sites for special task groups (such as a hunting party).[31] Bands likely moved between certain caves depending on the season, indicated by remains of seasonal materials such as certain foods, and returned to the same locations generation after generation. Some sites may have been used for over 100 years.[249] Cave bears may have greatly competed with Neanderthals for cave space, and there is a decline in cave bear populations starting 50,000 years ago onwards (although their extinction occurred well after Neanderthals had died out).[250][251] Although Neanderthals are generally considered to have been cave dwellers, with 'home base' being a cave, open-air settlements near contemporaneously inhabited cave systems in the Levant could indicate mobility between cave and open-air bases in this area. Evidence for long-term open-air settlements is known from the 'Ein Qashish site in Israel,[252][253] and Moldova I in Ukraine. Although Neanderthals appear to have had the ability to inhabit a range of environments—including plains and plateaux—open-air Neanderthals sites are generally interpreted as having been used as slaughtering and butchering grounds rather than living spaces.[84]

In 2022, remains of the first-known Neanderthal family (six adults and five children) were excavated from Chagyrskaya Cave in the Altai Mountains of southern Siberia in Russia. The family, which included a father, a daughter, and what appear to be cousins, most likely died together, presumably from starvation.[254][255]

Inter-group relations

Canadian ethnoarchaeologist Brian Hayden calculated a self-sustaining population that avoids inbreeding to consist of about 450–500 individuals, which would necessitate these bands to interact with 8–53 other bands, but more likely the larger estimate given low population density.[31] Analysis of the mtDNA of the Neanderthals of Cueva del Sidrón, Spain, showed that the three adult men belonged to the same maternal lineage, while the three adult women belonged to different ones. This suggests a patrilocal residence (that a woman moved out of her group to live with her partner).[256] However, the DNA of a Neanderthal from Denisova Cave, Russia, shows that she had an inbreeding coefficient of ⅛ (her parents were either half-siblings with a common mother, double first cousins, an uncle and niece or aunt and nephew, or a grandfather and granddaughter or grandmother and grandson)[91] and the inhabitants of Cueva del Sidrón show several defects, which may have been caused by inbreeding or recessive disorders.[238]

Considering most Neanderthal artifacts were sourced no more than 5 km (3.1 mi) from the main settlement, Hayden considered it unlikely these bands interacted very often,[31] and mapping of the Neanderthal brain and their small group size and population density could indicate that they had a reduced ability for inter-group interaction and trade.[198] However, a few Neanderthal artefacts in a settlement could have originated 20, 30, 100, and 300 km (12.5, 18.5, 60, and 185 mi) away. Based on this, Hayden also speculated that macro-bands formed which functioned much like those of the low-density hunter-gatherer societies of the Western Desert of Australia. Macro-bands collectively encompass 13,000 km^2 (5,000 sq mi), with each band claiming 1,200–2,800 km^2 (460–1,080 sq mi), maintaining strong alliances for mating networks or to cope with leaner times and enemies.[31] Similarly, British anthropologist

Eiluned Pearce and Cypriot archaeologist Theodora Moutsiou speculated that Neanderthals were possibly capable of forming geographically expansive ethnolinguistic tribes encompassing upwards of 800 people, based on the transport of obsidian up to 300 km (190 mi) from the source compared to trends seen in obsidian transfer distance and tribe size in modern hunter-gatherers. However, according to their model Neanderthals would not have been as efficient at maintaining long-distance networks as modern humans, probably due to a significantly lower population.[257] Hayden noted an apparent cemetery of six or seven individuals at La Ferrassie, France, which, in modern humans, is typically used as evidence of a corporate group which maintained a distinct social identity and controlled some resource, trading, manufacturing, and so on. La Ferrassie is also located in one of the richest animal-migration routes of Pleistocene Europe.[31]

Genetic analysis indicates there were at least three distinct geographical groups—Western Europe, the Mediterranean coast, and east of the Caucasus—with some migration among these regions.[83] Post-Eemian Western European Mousterian lithics can also be broadly grouped into three distinct macro-regions: Acheulean-tradition Mousterian in the southwest, Micoquien in the northeast, and Mousterian with bifacial tools (MBT) in between the former two. MBT may actually represent the interactions and fusion of the two different cultures.[82] Southern Neanderthals exhibit regional anatomical differences from northern counterparts: a less protrusive jaw, a shorter gap behind the molars, and a vertically higher jawbone.[258] These all instead suggest Neanderthal communities regularly interacted with neighbouring communities within a region, but not as often beyond.[82]

Nonetheless, over long periods of time, there is evidence of large-scale cross-continental migration. Early specimens from Mezmaiskaya Cave in the Caucasus[137] and Denisova Cave in the Siberian Altai Mountains[89] differ genetically from those found in Western Europe, whereas later specimens from these caves both have genetic profiles more similar to Western European Neanderthal specimens than to the earlier specimens from the same locations, suggesting long-range migration and population replacement over time.[89][137] Similarly, artefacts and DNA from Chagyrskaya and Okladnikov Caves, also in the Altai Mountains, resemble those of eastern European Neanderthal sites about 3,000–4,000 km (1,900–2,500 mi) away more than they do artefacts and DNA of the older Neanderthals from Denisova Cave, suggesting two distinct migration events into Siberia.[259] Neanderthals seem to have suffered a major population decline during MIS 4 (71–57 thousand years ago), and the distribution of the Micoquian tradition could indicate that Central Europe and the Caucasus were repopulated by communities from a refuge zone either in eastern France or Hungary (the fringes of the Micoquian tradition) who dispersed along the rivers Prut and Dniester.[260]

There is also evidence of inter-group conflict: a skeleton from La Roche à Pierrot, France, showing a healed fracture on top of the skull apparently caused by a deep blade wound,[261] and another from Shanidar Cave, Iraq, found to have a rib lesion characteristic of projectile weapon injuries.[262]

Social hierarchy

It is sometimes suggested that, since they were hunters of challenging big game and lived in small groups, there was no sexual division of labour as seen in modern hunter-gatherer societies. That is, men, women, and children all had to be involved in hunting, instead of men hunting with women and children foraging. However, with modern hunter-gatherers, the higher the meat dependency, the higher the division of labour.[31] Further, tooth-wearing patterns in Neanderthal men and women suggest they commonly used their teeth for carrying items, but men exhibit more wearing on the upper teeth, and women the lower, suggesting some cultural differences in tasks.[263]

It is controversially proposed that some Neanderthals wore decorative clothing or jewellery—such as a leopard skin or raptor feathers—to display elevated status in the group. Hayden postulated that the small number of Neanderthal graves found was because only high-ranking members would receive an elaborate burial, as is the case for some modern hunter-gatherers.[31] Trinkaus suggested that elderly Neanderthals were given special burial rites for lasting so long given the high mortality rates.[85] Alternatively, many more Neanderthals may have received burials, but the graves were infiltrated and destroyed by bears.[264] Given that 20 graves of Neanderthals aged under 4 have been found—over a third of all known graves—deceased children may have received greater care during burial than other age demographics.[248]

Looking at Neanderthal skeletons recovered from several natural rock shelters, Trinkaus said that, although Neanderthals were recorded as bearing several trauma-related injuries, none of them had significant trauma to the legs that would debilitate movement. He suggested that self-worth in Neanderthal culture derived from contributing food to the group; a debilitating injury would remove this self-worth and result in near-immediate death, and individuals who could not keep up with the group while moving from cave to cave were left behind.[85] However, there are examples of individuals with highly debilitating injuries being nursed for several years, and caring for the most vulnerable within the community dates even further back to *H. heidelbergensis*.[41][248] Especially given the high trauma rates, it is possible that such an altruistic strategy ensured their survival as a species for so long.[41]

Food

Hunting and gathering

Neanderthals were once thought of as scavengers, but are now considered to have been apex predators.[265][266] In 1980, it was hypothesised that two piles of mammoth skulls at La Cotte de St Brelade, Jersey, at the base of a gulley were evidence of mammoth drive hunting (causing them to stampede off a ledge),[267] but this is contested.[268] Living in a forested environment, Neanderthals were likely ambush hunters, getting close to and attacking their target—a prime adult—in a short burst of speed, thrusting in a spear at close quarters.[65][269] Younger or wounded animals may have been hunted using traps, projectiles, or pursuit.[269] Nonetheless, they were able to adapt to a variety of habitats.[50][268] They appear to have eaten predominantly what was abundant within their immediate surroundings,[52] with steppe-dwelling communities (generally outside of the Mediterranean) subsisting almost entirely on meat from large game, forest-dwelling communities consuming a wide array of plants and smaller animals, and waterside communities gathering aquatic resources. Contemporary humans, in contrast, seem to have used more complex food extraction strategies and generally had a more diverse diet.[270] Nonetheless, Neanderthals still would have had to have eaten a varied enough diet to prevent nutrient deficiencies and protein poisoning, especially in the winter when they presumably ate mostly lean meat. Any food with high contents of other essential nutrients not provided by lean meat would have been vital components of their diet, such as fat-rich brains,[41] carbohydrate-rich and abundant underground storage organs (including roots and tubers),[271] or, like modern Inuit, the stomach contents of herbivorous prey items.[272]

For meat, they appear to have fed predominantly on hoofed mammals, namely red deer and reindeer as these two were the most abundant game,[45] but also on other Pleistocene megafauna such as ibex, wild boar, aurochs, mammoth, straight-tusked elephant, woolly rhinoceros, and so on.[25][46][273] There is evidence of directed cave and brown bear hunting both in and out of hibernation, as well as butchering.[274] Analysis of Neanderthal bone collagen from Vindija Cave, Croatia, shows nearly all of their protein needs derived from animal meat.[46] Some caves show evidence of regular rabbit and tortoise consumption. At Gibraltar sites, there are remains of 143 different bird species, many ground-dwelling such as the common quail, corn crake, woodlark, and crested lark.[50] Neanderthals also exploited marine resources on the Iberian, Italian, and Peloponnesian Peninsulas, where they waded or dived for shellfish,[50][275][276] as early as 150,000 years ago at Cueva Bajondillo, Spain, similar to the fishing record of modern humans.[277] At Vanguard Cave, Gibraltar, the inhabitants consumed Mediterranean monk seal, short-beaked common dolphin, common bottlenose dolphin, Atlantic bluefin tuna, sea bream, and purple sea urchin;[50][278] and at Gruta da Figueira Brava, Portugal, there is evidence of large-scale harvest of shellfish, crabs, and fish.[279] Evidence of freshwater fishing was found in Grotte di Castelcivita, Italy, for trout, chub, and eel;[276] Abri du Maras, France, for chub and European perch; Payré, France;[280] and Kudaro Cave, Russia, for Black Sea salmon.[281] Edible plant and mushroom remains are recorded from several caves.[48] Neanderthals from Cueva del Sidrón, Spain, based on dental tartar, likely had a meatless diet of mushrooms, pine nuts, and moss, indicating they were forest foragers.[243] Remnants from Amud Cave, Israel, indicates a diet of figs, palm tree fruits, and various cereals and edible grasses.[49] Several bone traumas in the leg joints could possibly suggest habitual squatting, which, if the case, was likely done while gathering food.[282] Dental tartar from Grotte de Spy, Belgium, indicates the inhabitants had a meat-heavy diet including woolly rhinoceros and mouflon sheep, while also regularly consuming mushrooms.[243] Neanderthal faecal matter from El Salt, Spain, dated to 50,000 years ago—the oldest human faecal matter remains recorded—show a diet mainly of meat but with a significant component of plants.[283] Evidence of cooked plant foods—mainly legumes and, to a far lesser extent, acorns—was discovered in Kebara Cave, Israel, with its inhabitants possibly gathering plants in spring and fall and hunting in all seasons except fall, although the cave was probably abandoned in late summer to early fall.[39] At Shanidar Cave, Iraq, Neanderthals collected plants with various harvest seasons, indicating they scheduled returns to the area to harvest certain plants, and that they had complex food-gathering behaviours for both meat and plants.[47]

Food preparation

Neanderthals probably could employ a wide range of cooking techniques, such as roasting, and they may have been able to heat up or boil soup, stew, or animal stock.[43] The abundance of animal bone fragments at settlements may indicate the making of fat stocks from boiling bone marrow, possibly taken from animals that had already died of starvation. These methods would have substantially increased fat consumption, which was a major nutritional requirement of communities with low carbohydrate and high protein intake.[43][284] Neanderthal tooth size had a decreasing trend after 100,000 years ago, which could indicate an increased dependence on cooking or the advent of boiling, a technique that would have softened food.[285]

At Cueva del Sidrón, Spain, Neanderthals likely cooked and possibly smoked food,[44] as well as used certain plants—such as yarrow and camomile—as flavouring,[43] although these plants may have instead been used for their medicinal properties.[38] At Gorham's Cave, Gibraltar, Neanderthals may have been roasting pinecones to access pine nuts.[50]
At Grotte du Lazaret, France, a total of twenty-three red deer, six ibexes, three aurochs, and one roe deer appear to have been hunted in a single autumn hunting season, when strong male and female deer herds would group together for rut. The entire carcasses seem to have been transported to the cave and then butchered. Because this is such a large amount of food to consume before spoilage, it is possible these Neanderthals were curing and preserving it before winter set in. At 160,000 years old, it is the oldest potential evidence of food storage.[42] The great quantities of meat and fat which could have been gathered in general from typical prey items (namely mammoths) could also indicate food storage capability.[286] With shellfish, Neanderthals needed to eat, cook, or in some manner preserve them soon after collection, as shellfish spoils very quickly. At Cueva de los Aviones, Spain, the remains of edible, algae eating shellfish associated with the alga *Jania rubens* could indicate that, like some modern hunter gatherer societies, harvested shellfish were held in water-soaked algae to keep them alive and fresh until consumption.[287]

Competition

Competition from large Ice Age predators was rather high. Cave lions likely targeted horses, large deer and wild cattle; and leopards primarily reindeer and roe deer; which heavily overlapped with Neanderthal diet. To defend a kill against such ferocious predators, Neanderthals may have engaged in a group display of yelling, arm waving, or stone throwing; or quickly gathered meat and abandoned the kill. However, at Grotte de Spy, Belgium, the remains of wolves, cave lions, and cave bears—which were all major predators of the time—indicate Neanderthals hunted their competitors to some extent.[51]
Neanderthals and cave hyaenas may have exemplified niche differentiation, and actively avoided competing with each other. Although they both mainly targeted the same groups of creatures—deer, horses, and cattle—Neanderthals mainly hunted the former and cave hyaenas the latter two. Further, animal remains from Neanderthal caves indicate they preferred to hunt prime individuals, whereas cave hyaenas hunted weaker or younger prey, and cave hyaena caves have a higher abundance of carnivore remains.[45] Nonetheless, there is evidence that cave hyaenas stole food and leftovers from Neanderthal campsites and scavenged on dead Neanderthal bodies.[288]

Cannibalism

There are several instances of Neanderthals practising cannibalism across their range.[290][291] The first example came from the Krapina, Croatia site, in 1899,[119] and other examples were found at Cueva del Sidrón[258] and Zafarraya in Spain; and the French Grotte de Moula-Guercy,[292] Les Pradelles, and La Quina. For the five cannibalised Neanderthals at the Grottes de Goyet, Belgium, there is evidence that the upper limbs were disarticulated, the lower limbs defleshed and also smashed (likely to extract bone marrow), the chest cavity disemboweled, and the jaw dismembered. There is also evidence that the butchers used some bones to retouch their tools. The processing of Neanderthal meat at Grottes de Goyet is similar to how they processed horse and reindeer.[290][291] About 35% of the Neanderthals at Marillac-le-Franc, France, show clear signs of butchery, and the presence of digested teeth indicates that the bodies were abandoned and eaten by scavengers, likely hyaenas.[293]
These cannibalistic tendencies have been explained as either ritual defleshing, pre-burial defleshing (to prevent scavengers or foul smell), an act of war, or simply for food. Due to a small number of cases, and the higher number of cut marks seen on cannibalised individuals than animals (indicating inexperience), cannibalism was probably not a very common practice, and it may have only been done in times of extreme food shortages as in some cases in recorded human history.[291]

The arts

Personal adornment

Neanderthals used ochre, a clay earth pigment. Ochre is well-documented from 60 to 45 thousand years ago in Neanderthal sites, with the earliest example dating to 250–200 thousand years ago from Maastricht-Belvédère, the Netherlands (a similar timespan to the ochre record of *H. sapiens*).[294] It has been hypothesised to have functioned as body paint, and analyses of pigments from Pech de l'Azé, France, indicates they were applied to soft materials (such as a hide or human skin).[295] However, modern hunter gatherers, in addition to body paint, also use ochre for medicine, for tanning hides, as a food preservative, and as an insect repellent, so its use as decorative paint for Neanderthals is speculative.[294] Containers apparently used for mixing ochre pigments were found in Peștera Cioarei, Romania, which could indicate modification of ochre for solely aesthetic purposes.[296]
Neanderthals collected uniquely shaped objects and are suggested to have modified them into pendants, such as a fossil *Aspa marginata* sea snail shell possibly painted red from Grotta di Fumane, Italy, transported over 100 km (62 mi) to the site about 47,500 years ago;[297] three shells, dated to about 120–115 thousand years ago, perforated through the umbo belonging to a rough cockle, a *Glycymeris insubrica*, and a *Spondylus gaederopus* from Cueva de

los Aviones, Spain, the former two associated with red and yellow pigments, and the latter a red-to-black mix of hematite and pyrite; and a king scallop shell with traces of an orange mix of goethite and hematite from Cueva Antón, Spain. The discoverers of the latter two claim that pigment was applied to the exterior to make it match the naturally vibrant inside colouration.[55][287] Excavated from 1949 to 1963 from the French Grotte du Renne, Châtelperronian beads made from animal teeth, shells, and ivory were found associated with Neanderthal bones, but the dating is uncertain and Châtelperronian artefacts may actually have been crafted by modern humans and simply redeposited with Neanderthal remains.[298][299][300][301]

Gibraltarian palaeoanthropologists Clive and Geraldine Finlayson suggested that Neanderthals used various bird parts as artistic mediums, specifically black feathers.[302] In 2012, the Finlaysons and colleagues examined 1,699 sites across Eurasia, and argued that raptors and corvids, species not typically consumed by any human species, were overrepresented and show processing of only the wing bones instead of the fleshier torso, and thus are evidence of feather plucking of specifically the large flight feathers for use as personal adornment. They specifically noted the cinereous vulture, red-billed chough, kestrel, lesser kestrel, alpine chough, rook, jackdaw, and the white tailed eagle in Middle Palaeolithic sites.[303] Other birds claimed to present evidence of modifications by Neanderthals are the golden eagle, rock pigeon, common raven, and the bearded vulture.[304] The earliest claim of bird bone jewellery is a number of 130,000 year old white tailed eagle talons found in a cache near Krapina, Croatia, speculated, in 2015, to have been a necklace.[305][306] A similar 39,000-year-old Spanish imperial eagle talon necklace was reported in 2019 at Cova Foradà in Spain, though from the contentious Châtelperronian layer.[307] In 2017, 17 incision-decorated raven bones from the Zaskalnaya VI rock shelter, Ukraine, dated to 43–38 thousand years ago were reported. Because the notches are more-or-less equidistant to each other, they are the first modified bird bones that cannot be explained by simple butchery, and for which the argument of design intent is based on direct evidence.[53]

Discovered in 1975, the so-called Mask of la Roche-Cotard, a mostly flat piece of flint with a bone pushed through a hole on the midsection—dated to 32, 40, or 75 thousand years ago[308]—has been purported to resemble the upper half of a face, with the bone representing eyes.[309][310] It is contested whether it represents a face, or if it even counts as art.[311] In 1988, American archaeologist Alexander Marshack speculated that a Neanderthal at Grotte de L'Hortus, France, wore a leopard pelt as personal adornment to indicate elevated status in the group based on a recovered leopard skull, phalanges, and tail vertebrae.[31][312]

Abstraction

As of 2014, 63 purported engravings have been reported from 27 different European and Middle Eastern Lower-to-Middle Palaeolithic sites, of which 20 are on flint cortexes from 11 sites, 7 are on slabs from 7 sites, and 36 are on pebbles from 13 sites. It is debated whether or not these were made with symbolic intent.[57] In 2012, deep scratches on the floor of Gorham's Cave, Gibraltar, were discovered, dated to older than 39,000 years ago, which the discoverers have interpreted as Neanderthal abstract art.[313][314] The scratches could have also been produced by a bear.[264] In 2021, an Irish elk phalanx with five engraved offset chevrons stacked above each other was discovered at the entrance to the Einhornhöhle cave in Germany, dating to about 51,000 years ago.[315]

In 2018, some red-painted dots, disks, lines, and hand stencils on the cave walls of the Spanish La Pasiega, Maltravieso, and Doña Trinidad were dated to be older than 66,000 years ago, at least 20,000 years prior to the arrival of modern humans in Western Europe. This would indicate Neanderthal authorship, and similar iconography recorded in other Western European sites—such as Les Merveilles, France, and Cueva del Castillo, Spain—could potentially also have Neanderthal origins.[60][61][316] However, the dating of these Spanish caves, and thus attribution to Neanderthals, is contested.[59]

Neanderthals are known to have collected a variety of unusual objects—such as crystals or fossils—without any real functional purpose or any indication of damage caused by use. It is unclear if these objects were simply picked up for their aesthetic qualities, or if some symbolic significance was applied to them. These items are mainly quartz crystals, but also other minerals such as cerussite, iron pyrite, calcite, and galena. A few findings feature modifications, such as a mammoth tooth with an incision and a fossil nummulite shell with a cross etched in from Tata, Hungary; a large slab with 18 cupstones hollowed out from a grave in La Ferrassie, France;[56] and a geode from Peștera Cioarei, Romania, coated with red ochre.[317] A number of fossil shells are also known from French Neanderthals sites, such as a rhynchonellid and a *Taraebratulina* from Combe Grenal; a belemnite beak from Grottes des Canalettes; a polyp from Grotte de l'Hyène; a sea urchin from La Gonterie-Boulouneix; and a rhynchonella, feather star, and belemnite beak from the contentious Châtelperronian layer of Grotte du Renne.[56]

Music

Purported Neanderthal bone flute fragments made of bear long bones were reported from Potočka zijalka, Slovenia, in the 1920s, and Istállós-kői-barlang, Hungary,[318] and Mokriška jama, Slovenia, in 1985; but these are now attributed to modern human activities.[319][320] The 1995 43 thousand year old Divje Babe Flute from Slovenia has been

attributed by some researchers to Neanderthals, and Canadian musicologist Robert Fink said the original flute had either a diatonic or pentatonic musical scale.[321] However, the date also overlaps with modern human immigration into Europe, which means it is also possible it was not manufactured by Neanderthals.[322] In 2015, zoologist Cajus Diedrich argued that it was not a flute at all, and the holes were made by a scavenging hyaena as there is a lack of cut marks stemming from whittling,[320] but in 2018, Slovenian archaeologist Matija Turk and colleagues countered that it is highly unlikely the punctures were made by teeth, and cut marks are not always present on bone flutes.[58]

Technology

Despite the apparent 150 thousand year stagnation in Neanderthal lithic innovation,[172] there is evidence that Neanderthal technology was more sophisticated than was previously thought.[63] However, the high frequency of potentially debilitating injuries could have prevented very complex technologies from emerging, as a major injury would have impeded an expert's ability to effectively teach a novice.[231]

Stone tools

Neanderthals made stone tools, and are associated with the Mousterian industry.[27] The Mousterian is also associated with North African *H. sapiens* as early as 315,000 years ago[323] and was found in Northern China about 47–37 thousand years ago in caves such as Jinsitai or Tongtiandong.[324] It evolved around 300,000 years ago with the Levallois technique which developed directly from the preceding Acheulean industry (invented by *H. erectus* about 1.8 mya). Levallois made it easier to control flake shape and size, and as a difficult-to-learn and unintuitive process, the Levallois technique may have been directly taught generation to generation rather than via purely observational learning.[28]

There are distinct regional variants of the Mousterian industry, such as: the Quina and La Ferrassie subtypes of the Charentian industry in southwestern France, Acheulean-tradition Mousterian subtypes A and B along the Atlantic and northwestern European coasts,[325] the Micoquien industry of Central and Eastern Europe and the related Sibiryachikha variant in the Siberian Altai Mountains,[259] the Denticulate Mousterian industry in Western Europe, the racloir industry around the Zagros Mountains, and the flake cleaver industry of Cantabria, Spain, and both sides of the Pyrenees. In the mid-20th century, French archaeologist François Bordes debated against American archaeologist Lewis Binford to explain this diversity (the "Bordes–Binford debate"), with Bordes arguing that these represent unique ethnic traditions and Binford that they were caused by varying environments (essentially, form vs. function).[325] The latter sentiment would indicate a lower degree of inventiveness compared to modern humans, adapting the same tools to different environments rather than creating new technologies.[52] A continuous sequence of occupation is well-documented in Grotte du Renne, France, where the lithic tradition can be divided into the Levallois–Charentian, Discoid–Denticulate (43.3±0.929–40.9±0.719 thousand years ago), Levallois Mousterian (40.2±1.5–38.4±1.3 thousand years ago), and Châtelperronian (40.93±0.393–33.67±0.450 thousand years ago).[326]

There is some debate if Neanderthals had long-ranged weapons.[327][328] A wound on the neck of an African wild ass from Umm el Tlel, Syria, was likely inflicted by a heavy Levallois-point javelin,[329] and bone trauma consistent with habitual throwing has been reported in Neanderthals.[327][328] Some spear tips from Abri du Maras, France, may have been too fragile to have been used as thrusting spears, possibly suggesting their use as darts.[280]

Organic tools

The Châtelperronian in central France and northern Spain is a distinct industry from the Mousterian, and is controversially hypothesised to represent a culture of Neanderthals borrowing (or by process of acculturation) tool-making techniques from immigrating modern humans, crafting bone tools and ornaments. In this frame, the makers would have been a transitional culture between the Neanderthal Mousterian and the modern human Aurignacian.[330][331][332][333][334] The opposing viewpoint is that the Châtelperronian was manufactured by modern humans instead.[335] Abrupt transitions similar to the Mousterian/Châtelperronian could also simply represent natural innovation, like the La Quina–Neronian transition 50,000 years ago featuring technologies generally associated with modern humans such as bladelets and microliths. Other ambiguous transitional cultures include the Italian Uluzzian industry,[336] and the Balkan Szeletian industry.[337]

Before immigration, the only evidence of Neanderthal bone tools is animal rib lissoirs — which are rubbed against hide to make it more supple or waterproof — although this could also be evidence for modern humans immigrating earlier than expected. In 2013, two 51.4–41.1 thousand year old deer rib lissoirs were reported from Pech-de-l'Azé and the nearby Abri Peyrony in France.[332][99][99] In 2020, five more lissoirs made of aurochs or bison ribs were reported from Abri Peyrony, with one dating to about 51,400 years ago and the other four to 47.7–41.1 thousand years ago. This indicates the technology was in use in this region for a long time. Since reindeer remains were the most abundant, the use of less abundant bovine ribs may indicate a specific preference for bovine ribs. Potential lissoirs have also been reported from Grosse Grotte, Germany (made of mammoth), and Grottes des Canalettes, France (red deer).[338]

The Neanderthals in 10 coastal sites in Italy (namely Grotta del Cavallo and Grotta dei Moscerini) and Kalamakia Cave, Greece, are known to have crafted scrapers using smooth clam shells, and possibly hafted them to a wooden handle. They probably chose this clam species because it has the most durable shell. At Grotta dei Moscerini, about 24% of the shells were gathered alive from the seafloor, meaning these Neanderthals had to wade or dive into shallow waters to collect them. At Grotta di Santa Lucia, Italy, in the Campanian volcanic arc, Neanderthals collected the porous volcanic pumice, which, for contemporary humans, was probably used for polishing points and needles. The pumices are associated with shell tools.[276]

At Abri du Maras, France, twisted fibres and a 3-ply inner-bark-fibre cord fragment associated with Neanderthals show that they produced string and cordage, but it is unclear how widespread this technology was because the materials used to make them (such as animal hair, hide, sinew, or plant fibres) are biodegradable and preserve very poorly. This technology could indicate at least a basic knowledge of weaving and knotting, which would have made possible the production of nets, containers, packaging, baskets, carrying devices, ties, straps, harnesses, clothes, shoes, beds, bedding, mats, flooring, roofing, walls, and snares, and would have been important in hafting, fishing, and seafaring. Dating to 52–41 thousand years ago, the cord fragment is the oldest direct evidence of fibre technology, although 115,000-year-old perforated shell beads from Cueva Antón possibly strung together to make a necklace are the oldest indirect evidence.[35][280] In 2020, British archaeologist Rebecca Wragg Sykes expressed cautious support for the genuineness of the find, but pointed out that the string would have been so weak that it would have had limited functions. One possibility is as a thread for attaching or stringing small objects.[339]

The archaeological record shows that Neanderthals commonly used animal hide and birch bark, and may have used them to make cooking containers, although this is based largely on circumstantial evidence, because neither fossilizes well.[285] It is possible that the Neanderthals at Kebara Cave, Israel, used the shells of the spur-thighed tortoise as containers.[340]

At the Italian Poggetti Vecchi site, there is evidence that they used fire to process boxwood branches to make digging sticks, a common implement in hunter-gatherer societies.[341]

Fire and construction

Many Mousterian sites have evidence of fire, some for extended periods of time, though it is unclear whether they were capable of starting fire or simply scavenged from naturally occurring wildfires. Indirect evidence of fire-starting ability includes pyrite residue on a couple of dozen bifaces from late Mousterian (c. 50,000 years ago) northwestern France (which could indicate they were used as percussion fire starters), and collection of manganese dioxide by late Neanderthals which can lower the combustion temperature of wood.[29][30][342] They were also capable of zoning areas for specific activities, such as for knapping, butchering, hearths, and wood storage. Many Neanderthal sites lack evidence for such activity perhaps due to natural degradation of the area over tens of thousands of years, such as by bear infiltration after abandonment of the settlement.[264]

In a number of caves, evidence of hearths has been detected. Neanderthals likely considered air circulation when making hearths as a lack of proper ventilation for a single hearth can render a cave uninhabitable in several minutes. Abric Romaní rock shelter, Spain, indicates eight evenly spaced hearths lined up against the rock wall, likely used to stay warm while sleeping, with one person sleeping on either side of the fire.[31][32] At Cueva de Bolomor, Spain, with hearths lined up against the wall, the smoke flowed upwards to the ceiling, and led to outside the cave. In Grotte du Lazaret, France, smoke was probably naturally ventilated during the winter as the interior cave temperature was greater than the outside temperature; likewise, the cave was likely only inhabited in the winter.[32]

In 1990, two 176,000 year old ring structures, several metres wide, made of broken stalagmite pieces, were discovered in a large chamber more than 300 m (980 ft) from the entrance within Grotte de Bruniquel, France. One ring was 6.7 m × 4.5 m (22 ft × 15 ft) with stalagmite pieces averaging 34.4 cm (13.5 in) in length, and the other 2.2 m × 2.1 m (7.2 ft × 6.9 ft) with pieces averaging 29.5 cm (11.6 in). There were also four other piles of stalagmite pieces for a total of 112 m (367 ft) or 2.2 t (2.4 short tons) worth of stalagmite pieces. Evidence of the use of fire and burnt bones also suggest human activity. A team of Neanderthals was likely necessary to construct the structure, but the chamber's actual purpose is uncertain. Building complex structures so deep in a cave is unprecedented in the archaeological record, and indicates sophisticated lighting and construction technology, and great familiarity with subterranean environments.[343]

The 44,000-year-old Moldova I open-air site, Ukraine, shows evidence of a 7 m × 10 m (23 ft × 33 ft) ring-shaped dwelling made out of mammoth bones meant for long-term habitation by several Neanderthals, which would have taken a long time to build. It appears to have contained hearths, cooking areas, and a flint workshop, and there are traces of woodworking. Upper Palaeolithic modern humans in the Russian planes are thought to have also made housing structures out of mammoth bones.[84]

Birch tar

Neanderthal produced the adhesive birch bark tar, using the bark of birch trees, for hafting.[344] It was long believed that birch bark tar required a complex recipe to be followed, and that it thus showed complex cognitive skills and cultural transmission. However, a 2019 study showed it can be made simply by burning birch bark beside smooth vertical surfaces, such as a flat, inclined rock.[33] Thus, tar making does not require cultural processes per se. However, at Königsaue (Germany), Neanderthals did not make tar with such an aboveground method but rather employed a technically more demanding underground production method. This is one of our best indicators that some of their techniques were conveyed by cultural processes.[345]

Clothes

Neanderthals were likely able to survive in a similar range of temperatures to modern humans while sleeping: about 32 °C (90 °F) while naked in the open and windspeed 5.4 km/h (3.4 mph), or 27–28 °C (81–82 °F) while naked in an enclosed space. Since ambient temperatures were markedly lower than this—averaging, during the Eemian interglacial, 17.4 °C (63.3 °F) in July and 1 °C (34 °F) in January and dropping to as a low as −30 °C (−22 °F) on the coldest days—Danish physicist Bent Sørensen hypothesised that Neanderthals required tailored clothing capable of preventing airflow to the skin. Especially during extended periods of travelling (such as a hunting trip), tailored footwear completely enwrapping the feet may have been necessary.[346]

Nonetheless, as opposed to the bone sewing-needles and stitching awls assumed to have been in use by contemporary modern humans, the only known Neanderthal tools that could have been used to fashion clothes are hide scrapers, which could have made items similar to blankets or ponchos, and there is no direct evidence they could produce fitted clothes.[34][347] Indirect evidence of tailoring by Neanderthals includes the ability to manufacture string, which could indicate weaving ability,[280] and a naturally-pointed horse metatarsal bone from Cueva de los Aviones, Spain, which was speculated to have been used as an awl, perforating dyed hides, based on the presence of orange pigments.[287] Whatever the case, Neanderthals would have needed to cover up most of their body, and contemporary humans would have covered 80–90%.[347][348]

Since human/Neanderthal admixture is known to have occurred in the Middle East, and no modern body louse species descends from their Neanderthal counterparts (body lice only inhabit clothed individuals), it is possible Neanderthals (and/or humans) in hotter climates did not wear clothes, or Neanderthal lice were highly specialised.[348]

Seafaring

Remains of Middle Palaeolithic stone tools on Greek islands indicate early seafaring by Neanderthals in the Ionian Sea possibly starting as far back as 200–150 thousand years ago. The oldest stone artefacts from Crete date to 130–107 thousand years ago, Cephalonia 125 thousand years ago, and Zakynthos 110–35 thousand years ago. The makers of these artefacts likely employed simple reed boats and made one-day crossings back and forth.[36] Other Mediterranean islands with such remains include Sardinia, Melos, Alonnisos,[37] and Naxos (although Naxos may have been connected to land),[349] and it is possible they crossed the Strait of Gibraltar.[37] If this interpretation is correct, Neanderthals' ability to engineer boats and navigate through open waters would speak to their advanced cognitive and technical skills.[37][349]

Medicine

Given their dangerous hunting and extensive skeletal evidence of healing, Neanderthals appear to have lived lives of frequent traumatic injury and recovery. Well-healed fractures on many bones indicate the setting of splints. Individuals with severe head and rib traumas (which would have caused massive blood loss) indicate they had some manner of dressing major wounds, such as bandages made from animal skin. By-and-large, they appear to have avoided severe infections, indicating good long-term treatment of such wounds.[41]

Their knowledge of medicinal plants was comparable to that of contemporary humans.[41] An individual at Cueva del Sidrón, Spain, seems to have been medicating a dental abscess using poplar—which contains salicylic acid, the active ingredient in aspirin—and there were also traces of the antibiotic-producing *Penicillium chrysogenum*.[243] They may also have used yarrow and camomile, and their bitter taste—which should act as a deterrent as it could indicate poison—means it was likely a deliberate act.[38] In Kebara Cave, Israel, plant remains which have historically been used for their medicinal properties were found, including the common grape vine, the pistachios of the Persian turpentine tree, ervil seeds, and oak acorns.[39]

Language

The degree of language complexity is difficult to establish, but given that Neanderthals achieved some technical and cultural complexity, and interbred with humans, it is reasonable to assume they were at least fairly articulate, comparable to modern humans. A somewhat complex language—possibly using syntax—was likely necessary to survive in their harsh environment, with Neanderthals needing to communicate about topics such as locations, hunting and gathering, and tool-making techniques.[63][350][351] The FOXP2 gene in modern humans is associated with speech and language development. FOXP2 was present in Neanderthals,[352] but not the gene's modern human

variant.[353] Neurologically, Neanderthals had an expanded Broca's area—operating the formulation of sentences, and speech comprehension, but out of a group of 48 genes believed to affect the neural substrate of language, 11 had different methylation patterns between Neanderthals and modern humans. This could indicate a stronger ability in modern humans than in Neanderthals to express language.[354]

In 1971, cognitive scientist Philip Lieberman attempted to reconstruct the Neanderthal vocal tract and concluded that it was similar to that of a newborn and incapable of producing a large range of speech sounds, due to the large size of the mouth and the small size of the pharyngeal cavity (according to his reconstruction), thus no need for a descended larynx to fit the entire tongue inside the mouth. He claimed that they were anatomically unable to produce the sounds /a/, /i/, /u/, /ɔ/, /g/, and /k/ and thus lacked the capacity for articulate speech, though were still able to speak at a level higher than non-human primates.[355][356][357] However, the lack of a descended larynx does not necessarily equate to a reduced vowel capacity.[358] The 1983 discovery of a Neanderthal hyoid bone—used in speech production in humans—in Kebara 2 which is almost identical to that of humans suggests Neanderthals were capable of speech. Also, the ancestral Sima de los Huesos hominins had humanlike hyoid and ear bones, which could suggest the early evolution of the modern human vocal apparatus. However, the hyoid does not definitively provide insight into vocal tract anatomy.[64] Subsequent studies reconstruct the Neanderthal vocal apparatus as comparable to that of modern humans, with a similar vocal repertoire.[359] In 2015, Lieberman hypothesized that Neanderthals were capable of syntactical language, although nonetheless incapable of mastering any human dialect.[360]

It is debated if behavioural modernity is a recent and uniquely modern human innovation, or if Neanderthals also possessed it.[361][351][362][54]

Religion

Funerals

Claims that Neanderthals held funerals for their dead with symbolic meaning[363] are heavily contested and speculative.[364][365][366] Although Neanderthals did bury their dead, at least occasionally—which may explain the abundance of fossil remains—[52] it is not indicative of a religious belief of life after death, as such burial could have also had non-symbolic motivations, such as great emotion[367] or to prevent scavenging.[368]

Estimates made regarding the number of known Neanderthal burials range from thirty-six to sixty.[369][370][371][372] The oldest confirmed burials do not seem to occur before approximately 70,000 years ago.[373] The small number of recorded Neanderthal burials implies that the activity was not particularly common. The setting of inhumation in Neanderthal culture largely consisted of simple, shallow graves and pits.[374] Sites such as La Ferrassie in France or Shanidar in Iraq may imply the existence of mortuary centers or cemeteries in Neanderthal culture due to the number of individuals found buried at them.[374]

The debate on Neanderthal funerals has been active since the 1908 discovery of La Chapelle-aux-Saints 1 in a small, artificial hole in a cave in southwestern France, very controversially postulated to have been buried in a symbolic fashion.[364][375][376] Another grave at Shanidar Cave, Iraq, was associated with the pollen of several flowers that may have been in bloom at the time of deposition—yarrow, centaury, ragwort, grape hyacinth, joint pine, and hollyhock.[377] The medicinal properties of the plants led American archaeologist Ralph Solecki to claim that the man buried was some leader, healer, or shaman, and that "The association of flowers with Neanderthals adds a whole new dimension to our knowledge of his humanness, indicating that he had 'soul' ".[378] However, it is also possible the pollen was deposited by a small rodent after the man's death.[379]

The graves of children and infants, especially, are associated with grave goods such as artefacts and bones. The grave of a newborn from La Ferrassie, France, was found with three flint scrapers, and an infant from Dederiyeh [de] Cave, Syria, was found with a triangular flint placed on its chest. A 10-month-old from Amud Cave, Israel, was associated with a red deer mandible, likely purposefully placed there given other animal remains are now reduced to fragments. Teshik-Tash 1 from Uzbekistan was associated with a circle of ibex horns, and a limestone slab argued to have supported the head.[248] A child from Kiik-Koba, Crimea, Ukraine, had a flint flake with some purposeful engraving on it, likely requiring a great deal of skill.[57] Nonetheless, these contentiously constitute evidence of symbolic meaning as the grave goods' significance and worth are unclear.[248]

Cults

It was once argued that the bones of the cave bear, particularly the skull, in some European caves were arranged in a specific order, indicating an ancient bear cult that killed bears and then ceremoniously arranged the bones. This would be consistent with bear-related rituals of modern human Arctic hunter-gatherers, but the alleged peculiarity of the arrangement could also be well-explained by natural causes,[62][367] and bias could be introduced as the existence of a bear cult would conform with the idea that totemism was the earliest religion, leading to undue extrapolation of evidence.[380]

It was also once thought that Neanderthals ritually hunted, killed, and cannibalised other Neanderthals and used the skull as the focus of some ceremony.[291] In 1962, Italian palaeontologist Alberto Blanc believed a skull from Grotta Guattari, Italy, had evidence of a swift blow to the head—indicative of ritual murder—and a precise and deliberate incising at the base to access the brain. He compared it to the victims of headhunters in Malaysia and Borneo,[381] putting it forward as evidence of a skull cult.[367] However, it is now thought to have been a result of cave hyaena scavengery.[382] Although Neanderthals are known to have practiced cannibalism, there is unsubstantial evidence to suggest ritual defleshing.[290]

In 2019, Gibraltarian palaeoanthropologists Stewart, Geraldine, and Clive Finlayson and Spanish archaeologist Francisco Guzmán speculated that the golden eagle had iconic value to Neanderthals, as exemplified in some modern human societies because they reported that golden eagle bones had a conspicuously high rate of evidence of modification compared to the bones of other birds. They then proposed some "Cult of the Sun Bird" where the golden eagle was a symbol of power.[304][54] There is evidence from Krapina, Croatia, from wear use and even remnants of string, that suggests that raptor talons were worn as personal ornaments.[383]

Interbreeding

Interbreeding with modern humans

The first Neanderthal genome sequence was published in 2010, and strongly indicated interbreeding between Neanderthals and early modern humans.[86][385][386][387] The genomes of all non-sub-Saharan populations contain Neanderthal DNA.[86][88][388][389] Various estimates exist for the proportion, such as 1–4%[86] or 3.4–7.9% in modern Eurasians,[390] or 1.8–2.4% in modern Europeans and 2.3–2.6% in modern East Asians.[391] Pre-agricultural Europeans appear to have had similar percentages to modern East Asians, and the numbers may have decreased in the former due to dilution with a group of people which had split off before Neanderthal introgression.[99] Typically, studies have reported finding no significant levels of Neanderthal DNA in Subsaharan Africans, but a 2020 study detected 0.3-0.5% in the genomes of five African sample populations, likely the result of Eurasians back-migrating and interbreeding with Africans, as well as human-to-neanderthal gene flow from dispersals of *Homo sapiens* preceding the larger Out-of-Africa migration.[392] Such low percentages of Neanderthal DNA in all present day populations indicate infrequent past interbreeding,[393] unless interbreeding was more common with a different population of modern humans which did not contribute to the present day gene pool.[99] Of the inherited Neanderthal genome, 25% in modern Europeans and 32% in modern East Asians may be related to viral immunity.[394] In all, approximately 20% of the Neanderthal genome appears to have survived in the modern human gene pool.[93]

However, due to their small population and resulting reduced effectivity of natural selection, Neanderthals accumulated several weakly harmful mutations, which were introduced to and slowly selected out of the much larger modern human population; the initial hybridised population may have experienced up to a 94% reduction in fitness compared to contemporary humans. By this measure, Neanderthals may have substantially increased in fitness.[81] A 2017 study focusing on archaic genes in Turkey found associations with coeliac disease, malaria severity, and Costello syndrome.[396] Nonetheless, some genes may have helped modern East Asians adapt to the environment; the putatively Neanderthal Val92Met variant of the MC1R gene, which may be weakly associated with red hair and UV radiation sensitivity,[397] is primarily found in East Asian, rather than European, individuals.[398] Some genes related to the immune system appear to have been affected by introgression, which may have aided migration,[95] such as OAS1,[399] STAT2,[400] TLR6, TLR1, TLR10,[401] and several related to immune response.[94][f] In addition, Neanderthal genes have also been implicated in the structure and function of the brain,[g] keratin filaments, sugar metabolism, muscle contraction, body fat distribution, enamel thickness, and oocyte meiosis.[98] Nonetheless, a large portion of surviving introgression appears to be non-coding ("junk") DNA with few biological functions.[99]

Due to the absence of Neanderthal-derived mtDNA (which is passed on from mother to child) in modern populations,[135][152][403] it has been suggested that the progeny of Neanderthal females who mated with modern human males were either rare, absent, or sterile—that is to say, admixture stems from the progeny of Neanderthal males with modern human females.[87][133][403][404][99][*excessive citations*] Due to the lack of Neanderthal-derived Y-chromosomes in modern humans (which is passed on from father to son), it has also been suggested that the hybrids that contributed ancestry to modern populations were predominantly females, or the Neanderthal Y-chromosome was not compatible with *H. sapiens* and became extinct.[405][99]

According to linkage disequilibrium mapping, the last Neanderthal gene flow into the modern human genome occurred 86–37 thousand years ago, but most likely 65–47 thousand years ago.[406] It is thought that Neanderthal genes which contributed to the present day human genome stemmed from interbreeding in the Near East rather than the entirety of Europe. However, interbreeding still occurred without contributing to the modern genome.[99] The approximately 40,000 year old modern human Oase 2 was found, in 2015, to have had 6–9% (point estimate 7.3%) Neanderthal DNA, indicating a Neanderthal ancestor up to four to six generations earlier, but this hybrid population

does not appear to have made a substantial contribution to the genomes of later Europeans.[395] In 2016, the DNA of Neanderthals from Denisova Cave revealed evidence of interbreeding 100,000 years ago, and interbreeding with an earlier dispersal of *H. sapiens* may have occurred as early as 120,000 years ago in places such as the Levant.[90] The earliest *H. sapiens* remains outside of Africa occur at Misliya Cave 194–177 thousand years ago, and Skhul and Qafzeh 120–90 thousand years ago.[407] The Qafzeh humans lived at approximately the same time as the Neanderthals from the nearby Tabun Cave.[408] The Neanderthals of the German Hohlenstein-Stadel have deeply divergent mtDNA compared to more recent Neanderthals, possibly due to introgression of human mtDNA between 316 and 219 thousand years ago, or simply because they were genetically isolated.[89] Whatever the case, these first interbreeding events have not left any trace in modern human genomes.[409]

Detractors of the interbreeding model argue that the genetic similarity is only a remnant of a common ancestor instead of interbreeding,[410] although this is unlikely as it fails to explain why sub-Saharan Africans do not have Neanderthal DNA.[386]

Interbreeding with Denisovans

Although nDNA confirms that Neanderthals and Denisovans are more closely related to each other than they are to modern humans, Neanderthals and modern humans share a more recent maternally-transmitted mtDNA common ancestor, possibly due to interbreeding between Denisovans and some unknown human species. The 400,000-year-old Neanderthal-like humans from Sima de los Huesos in northern Spain, looking at mtDNA, are more closely related to Denisovans than Neanderthals. Several Neanderthal-like fossils in Eurasia from a similar time period are often grouped into *H. heidelbergensis*, of which some may be relict populations of earlier humans, which could have interbred with Denisovans.[412] This is also used to explain an approximately 124,000 year old German Neanderthal specimen with mtDNA that diverged from other Neanderthals (except for Sima de los Huesos) about 270,000 years ago, while its genomic DNA indicated divergence less than 150,000 years ago.[89]

Sequencing of the genome of a Denisovan from Denisova Cave has shown that 17% of its genome derives from Neanderthals.[92] This Neanderthal DNA more closely resembled that of a 120,000-year-old Neanderthal bone from the same cave than that of Neanderthals from Vindija Cave, Croatia, or Mezmaiskaya Cave in the Caucasus, suggesting that interbreeding was local.[91]

For the 90,000-year-old Denisova 11, it was found that her father was a Denisovan related to more recent inhabitants of the region, and her mother a Neanderthal related to more recent European Neanderthals at Vindija Cave, Croatia. Given how few Denisovan bones are known, the discovery of a first-generation hybrid indicates interbreeding was very common between these species, and Neanderthal migration across Eurasia likely occurred sometime after 120,000 years ago.[413]

Yorum

Küçük topluluklar halinde yaşamaları, insan, Homo sapiens, sapiens tarafından kaldırılması iddiasında da bulunulmaktadır. Birlikte 3-5bin yıl oldukları sanılmaktadır.

Düşük doğurganlıklar, iklim değişikliği, hastalıklar gibi faktörler yok oluşları nedeni olarak sayılmaktadır.

Extinction

Transition

Whatever the cause of their extinction, Neanderthals were replaced by modern humans, indicated by near full replacement of Middle Palaeolithic Mousterian stone technology with modern human Upper Palaeolithic Aurignacian stone technology across Europe (the Middle-to-Upper Palaeolithic Transition) from 41 to 39 thousand years ago.[8][9][11][414] However, it is postulated that Iberian Neanderthals persisted until about 35,000 years ago, as indicated by the date range of transitional lithic assemblages—Châtelperronian, Uluzzian, Protoaurignacian, and Early Aurignacian. The latter two are attributed to modern humans, but the former two have unconfirmed authorship, potentially products of Neanderthal/modern human cohabitation and cultural transmission. Further, the appearance of the Aurignacian south of the Ebro River has been dated to roughly 37,500 years ago, which has prompted the "Ebro Frontier" hypothesis which states that the river presented a geographic barrier preventing modern human immigration, and thus prolonging Neanderthal persistence.[415][416] However, the dating of the Iberian Transition is debated, with a contested timing of 43–40.8 thousand years ago at Cueva Bajondillo, Spain.[417][418][419][420] The Châtelperronian appears in northeastern Iberia about 42.5–41.6 thousand years ago.[415]

Some Neanderthals in Gibraltar were dated to much later than this—such as Zafarraya (30,000 years ago)[421] and Gorham's Cave (28,000 years ago)[422]—which may be inaccurate as they were based on ambiguous artefacts instead of direct dating.[11] A claim of Neanderthals surviving in a polar refuge in the Ural Mountains[165] is loosely supported

by Mousterian stone tools dating to 34–31 thousand years ago from the northern Siberian Byzovaya site at a time when modern humans may not yet have colonised the northern reaches of Europe;[167] however, modern human remains are known from the nearby Mamontovaya Kurya site dating to 40,000 years ago.[423] Indirect dating of Neanderthals remains from Mezmaiskaya Cave reported a date of about 30,000 years ago, but direct dating instead yielded 39.7±1.1 thousand years ago, more in line with trends exhibited in the rest of Europe.[10]

The earliest indication of Upper Palaeolithic modern human immigration into Europe is the Balkan Bohunician industry beginning 48,000 years ago, likely deriving from the Levantine Emiran industry,[337] and the earliest bones in Europe date to roughly 45–43 thousand years ago in Bulgaria,[424] Italy,[425] and Britain.[426] This wave of modern humans replaced Neanderthals.[8] However, Neanderthals and *H. sapiens* have a much longer contact history. DNA evidence indicates *H. sapiens* contact with Neanderthals and admixture as early as 120–100 thousand years ago. A 2019 reanalysis of 210,000 year old skull fragments from the Greek Apidima Cave assumed to have belonged to a Neanderthal concluded that they belonged to a modern human, and a Neanderthal skull dating to 170,000 years ago from the cave indicates *H. sapiens* were replaced by Neanderthals until returning about 40,000 years ago.[427] This identification was refuted by a 2020 study.[428] Archaeological evidence suggests that Neanderthals displaced modern humans in the Near East around 100,000 years ago until about 60–50 thousand years ago.[99]

Cause

Modern humans

Historically, modern human technology was viewed as vastly superior to that of Neanderthals, with more efficient weaponry and subsistence strategies, and Neanderthals simply went extinct because they could not compete.[15]

The discovery of Neanderthal/modern human introgression has caused the resurgence of the multiregional hypothesis, wherein the present day genetic makeup of all humans is the result of complex genetic contact among several different populations of humans dispersed across the world. By this model, Neanderthals and other recent archaic humans were simply assimilated into the modern human genome – that is, they were effectively bred out into extinction.[15] Modern humans coexisted with Neanderthals in Europe for around 3,000 to 5,000 years.[429]

Climate change

Their ultimate extinction coincides with Heinrich event 4, a period of intense seasonality; later Heinrich events are also associated with massive cultural turnovers when European human populations collapsed.[16][17] This climate change may have depopulated several regions of Neanderthals, like previous cold spikes, but these areas were instead repopulated by immigrating humans, leading to Neanderthal extinction.[430]

It has also been proposed that climate change was the primary driver, as their low population left them vulnerable to any environmental change, with even a small drop in survival or fertility rates possibly quickly leading to their extinction.[431] However, Neanderthals and their ancestors had survived through several glacial periods over their hundreds of thousands of years of European habitation.[270] It is also proposed that around 40,000 years ago, when Neanderthal populations may have already been dwindling from other factors, the Campanian Ignimbrite Eruption in Italy could have led to their final demise, as it produced 2–4 °C cooling for a year and acid rain for several more years.[18][432]

Disease

Modern humans may have introduced African diseases to Neanderthals, contributing to their extinction. A lack of immunity, compounded by an already low population, was potentially devastating to the Neanderthal population, and low genetic diversity could have also rendered fewer Neanderthals naturally immune to these new diseases ("differential pathogen resistance" hypothesis). However, compared to modern humans, Neanderthals had a similar or higher genetic diversity for 12 major histocompatibility complex (MHC) genes associated with the adaptive immune system, casting doubt on this model.[20]

Low population and inbreeding depression may have caused maladaptive birth defects, which could have contributed to their decline (mutational meltdown).[238]

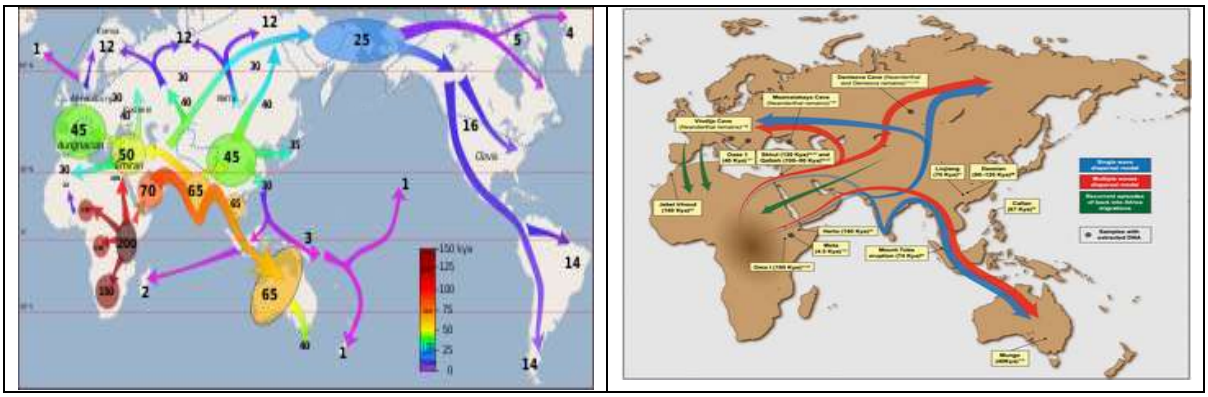
In late-20th-century New Guinea, due to cannibalistic funerary practices, the Fore people were decimated by transmissible spongiform encephalopathies, specifically kuru, a highly virulent disease spread by ingestion of prions found in brain tissue. However, individuals with the 129 variants of the PRNP gene were naturally immune to the prions. Studying this gene led to the discovery that the 129 variant was widespread among all modern humans, which could indicate widespread cannibalism at some point in human prehistory. Because Neanderthals are known to have practised cannibalism to an extent and to have co-existed with modern humans, British palaeoanthropologist Simon Underdown speculated that modern humans transmitted a kuru-like spongiform disease to Neanderthals, and, because the 129 variant appears to have been absent in Neanderthals, it quickly killed them off.[19][433]

In popular culture

Neanderthals have been portrayed in popular culture including appearances in literature, visual media, and comedy. The "caveman" archetype often mocks Neanderthals and depicts them as primitive, hunchbacked, knuckle-dragging, club-wielding, grunting, nonsocial characters driven solely by animal instinct. "Neanderthal" can also be used as an insult.[25]

In literature, they are sometimes depicted as brutish or monstrous, such as in H. G. Wells' *The Grisly Folk* and Elizabeth Marshall Thomas' *The Animal Wife*, but sometimes with a civilised but unfamiliar culture, as in William Golding's *The Inheritors*, Björn Kurtén's *Dance of the Tiger*, and Jean M. Auel's *Clan of the Cave Bear* and her *Earth's Children* series.[26]

Homo sapiens, sapiens dağılımı



Şekil 4: 170-300 bin yıl önce ilk Afrika'da gözlenmiş, daha sonra koloniler halinde göç edilmiştir.

Evolution

Humans are apes (superfamily Hominoidea).[13] The lineage of apes that eventually gave rise to humans first split from gibbons (family Hylobatidae) and orangutans (genus *Pongo*), then gorillas (genus *Gorilla*), and finally, chimpanzees and bonobos (genus *Pan*). The last split, between the human and chimpanzee–bonobo lineages, took place around 8–4 million years ago, in the late Miocene epoch.[14][15] During this split, chromosome 2 was formed from the joining of two other chromosomes, leaving humans with only 23 pairs of chromosomes, compared to 24 for the other apes.[16] Following their split with chimpanzees and bonobos, the hominins diversified into many species and at least two distinct genera. All but one of these lineages – representing the genus *Homo* and its sole extant species *Homo sapiens* – are now extinct.[17]

The genus *Homo* evolved from *Australopithecus*.[18][19] Though fossils from the transition are scarce, the earliest members of *Homo* share several key traits with *Australopithecus*.[20][21] The earliest record of *Homo* is the 2.8 million-year-old specimen LD 350-1 from Ethiopia, and the earliest named species are *Homo habilis* and *Homo rudolfensis* which evolved by 2.3 million years ago.[21] *H. erectus* (the African variant is sometimes called *H. ergaster*) evolved 2 million years ago and was the first archaic human species to leave Africa and disperse across Eurasia.[22] *H. erectus* also was the first to evolve a characteristically human body plan. *Homo sapiens* emerged in Africa around 300,000 years ago from a species commonly designated as either *H. heidelbergensis* or *H. rhodesiensis*, the descendants of *H. erectus* that remained in Africa.[23] *H. sapiens* migrated out of the continent, gradually replacing or interbreeding with local populations of archaic humans.[24][25][26] Humans began exhibiting behavioral modernity about 160,000–70,000 years ago,[27] and possibly earlier.[28]

The "out of Africa" migration took place in at least two waves, the first around 130,000 to 100,000 years ago, the second (Southern Dispersal) around 70,000 to 50,000 years ago.[29][30] *H. sapiens* proceeded to colonize all the continents and larger islands, arriving in Eurasia 125,000 years ago,[31][32] Australia around 65,000 years ago,[33] the Americas around 15,000 years ago, and remote islands such as Hawaii, Easter Island, Madagascar, and New Zealand between the years 300 and 1280 CE.[34][35]

Human evolution was not a simple linear or branched progression but involved interbreeding between related species.[36][37][38] Genomic research has shown that hybridization between substantially diverged lineages was common in human evolution.[39] DNA evidence suggests that several genes of Neanderthal origin are present

among all non-sub-Saharan African populations, and Neanderthals and other hominins, such as Denisovans, may have contributed up to 6% of their genome to present-day non sub-Saharan African humans.[36][40][41]
Human evolution is characterized by a number of morphological, developmental, physiological, and behavioral changes that have taken place since the split between the last common ancestor of humans and chimpanzees. The most significant of these adaptations are hairlessness,[42] obligate bipedalism, increased brain size and decreased sexual dimorphism (neoteny). The relationship between all these changes is the subject of ongoing debate.[43]

History

Overview map of the peopling of the world by early human migration during the Upper Paleolithic, following to the Southern Dispersal paradigm

Yorum

Genetik olmayan yaklaşımlar bilimsel olarak zayıf ve kabul edilemez olmalıdır. Öngörüler elbet olabilir ama ispatlı olması beklenmelidir.
Bilgi için metin olduğu gibi sunulmuştur, okumak isteyen faydalanabilir.

Early human migrations, Wikipedia[4]

Putative migration waves out of Africa and back migrations into the continent, as well as the locations of major ancient human remains and archeological sites (López et al.2015).

Early human migrations are the earliest migrations and expansions of archaic and modern humans across continents. They are believed to have begun approximately 2 million years ago with the early expansions out of Africa by *Homo erectus*. This initial migration was followed by other archaic humans including *H. heidelbergensis*, which lived around 500,000 years ago and was the likely ancestor of Denisovans and Neanderthals as well as modern humans. Early hominids had likely crossed land bridges that have now sunk.

Within Africa, *Homo sapiens* dispersed around the time of its speciation, roughly 300,000 years ago.[note 1] The recent African origin paradigm suggests that the anatomically modern humans outside of Africa descend from a population of *Homo sapiens* migrating from East Africa roughly 70–50,000 years ago and spreading along the southern coast of Asia and to Oceania by about 50,000 years ago. Modern humans spread across Europe about 40,000 years ago.

Early Eurasian *Homo sapiens* fossils have been found in Israel and Greece, dated to 194,000–177,000 and 210,000 years old respectively. These fossils seem to represent failed dispersal attempts by early *Homo sapiens*, who were likely replaced by local Neanderthal populations.

The migrating modern human populations are known to have interbred with earlier local populations, so that contemporary human populations are descended in small part (below 10% contribution) from regional varieties of archaic humans.[note 2]

After the Last Glacial Maximum, North Eurasian populations migrated to the Americas about 20,000 years ago. Arctic Canada and Greenland were reached by the Paleo-Eskimo expansion around 4,000 years ago. Finally, Polynesia was populated within the past 2,000 years in the last wave of the Austronesian expansion.

Early humans (before *Homo sapiens*)

The earliest humans developed out of australopithecine ancestors about 3 million years ago, most likely in the area of the Kenyan Rift Valley, where the oldest known stone tools have been found. Stone tools recently discovered at the Shangchen site in China and dated to 2.12 million years ago are claimed to be the earliest known evidence of hominins outside Africa, surpassing Dmanisi in Georgia by 300,000 years.[6]

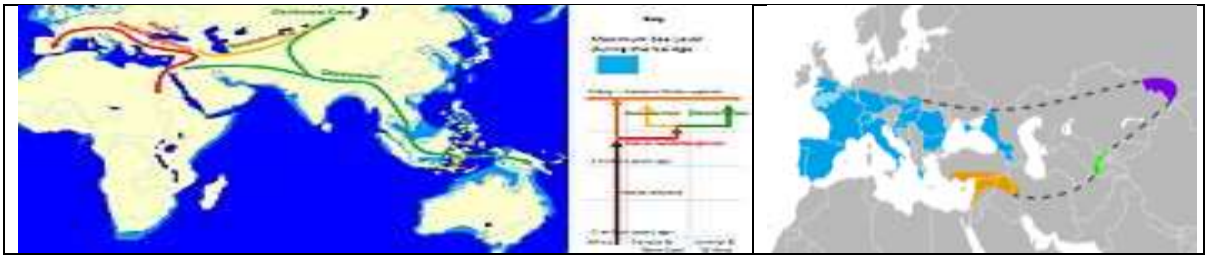
Homo erectus

Between 2 and less than a million years ago, *Homo* spread throughout East Africa and to Southern Africa (*Homo ergaster*), but not yet to West Africa. Around 1.8 million years ago, *Homo erectus* migrated out of Africa via the Levantine corridor and Horn of Africa to Eurasia. This migration has been proposed as being related to the operation of the Saharan pump, around 1.9 million years ago.[*citation needed*] *Homo erectus* dispersed throughout most of the Old World, reaching as far as Southeast Asia. Its distribution is traced by the Oldowan lithic industry, by 1.3 million years ago extending as far north as the 40th parallel (Xiaochangliang).

Key sites for this early migration out of Africa are Riwat in Pakistan (~2 Ma?[7]), Ubeidiya in the Levant (1.5 Ma) and Dmanisi in the Caucasus (1.81 ± 0.03 Ma, p=0.05[8]).

China shows evidence of *Homo erectus* from 2.12 mya in Gongwangling, in Lantian county.[9] Two *Homo erectus* incisors have been found near Yuanmou, southern China, and are dated to 1.7 mya, and a cranium from Lantian has been dated to 1.63 mya. Artefacts from Majuangou III and Shangshazui in the Nihewan basin, northern China, have been dated to 1.6–1.7 mya.[9][10] The archaeological site of Xihoudu (西侯渡) in Shanxi province is the earliest recorded use of fire by *Homo erectus*, which is dated 1.27 million years ago.[11] Southeast Asia (Java) was reached about 1.7 million years ago ("Meganthropus"). Western Europe was first populated around 1.2 million years ago (Atapuerca).[12]
Robert G. Bednarik has suggested that *Homo erectus* may have built rafts and sailed oceans, a theory that has raised some controversy.[13]
After *H. erectus*

Homo erectus ve Neandertal dağılımı



Şekil 5: Farklı yayınlarda değişik gösterilmesi doğal karşılanmalıdır. Bu nedenle her dağılım haritaları verilmektedir. Konumuz temelde göçler olduğu dikkate alınmalıdır.

Spread of Denisovans and Neanderthals after 500,000 years ago Known Neanderthal range with separate populations in Europe and the Caucasus (blue), the Near East (orange), Uzbekistan (green), and the Altai region (purple)
One million years after its dispersal, *H. erectus* was diverging into new species. *H. erectus* is a chronospecies and was never extinct, so its "late survival" is a matter of taxonomic convention. Late forms of *H. erectus* are thought to have survived until after about 0.5 million ago to 143,000 years ago at the latest,[note 3] with derived forms classified as *H. antecessor* in Europe around 800,000 years ago and *H. heidelbergensis* in Africa around 600,000 years ago. *H. heidelbergensis* in its turn spread across East Africa (*H. rhodesiensis*) and to Eurasia, where it gave rise to Neanderthals and Denisovans.
H. heidelbergensis, Neanderthals and Denisovans expanded north beyond the 50th parallel (Eartham Pit, Boxgrove 500kya, Swanscombe Heritage Park 400kya, Denisova Cave 50 kya). It has been suggested that late Neanderthals may even have reached the boundary of the Arctic, by c. 32,000 years ago, when they were being displaced from their earlier habitats by *H. sapiens*, based on 2011 excavations at the site of Byzovaya in the Urals (Komi Republic, 65.02°N 57.42°E).[15]
Other archaic human species are assumed to have spread throughout Africa by this time, although the fossil record is sparse. Their presence is assumed based on traces of admixture with modern humans found in the genome of African populations.[5][16][17][18] *Homo naledi*, discovered in South Africa in 2013 and tentatively dated to about 300,000 years ago, may represent fossil evidence of such an archaic human species.[19]
Neanderthals spread across the Near East and Europe, while Denisovans appear to have spread across Central and East Asia and to Southeast Asia and Oceania. There is evidence that Denisovans interbred with Neanderthals in Central Asia where their habitats overlapped.[20] Neanderthal evidence has also been found quite late at 33,000 years ago at the 65th latitude of the Byzovaya site in the Ural Mountains. This is far outside of any otherwise known habitat, during a high ice cover period, and perhaps reflects a refugia of near extinction.
Homo sapiens
Dispersal throughout Africa
Homo sapiens are believed to have emerged in Africa about 300,000 years ago, based in part on thermoluminescence dating of artifacts and remains from Jebel Irhoud, Morocco, published in 2017.[note 4][22] The Florisbad Skull from Florisbad, South Africa, dated to about 259,000 years ago, has also been classified as early *Homo sapiens*.[23][24][25][26] Previously, the Omo remains, excavated between 1967 and 1974 in Omo National Park, Ethiopia, and dated to 200,000 years ago, were long held to be the oldest known fossils of *Homo sapiens*.[27]

In September 2019, scientists reported the computerized determination, based on 260 CT scans, of a virtual skull shape of the last common human ancestor to anatomically modern humans, representative of the earliest modern humans, and suggested that modern humans arose between 260,000 and 350,000 years ago through a merging of populations in East and South Africa.[28][29]

In July 2019, anthropologists reported the discovery of 210,000 year old remains of a *H. sapiens* and 170,000 year old remains of a *H. neanderthalensis* in Apidima Cave in southern Greece, more than 150,000 years older than previous *H. sapiens* finds in Europe.[30][31][32][33]

Early modern humans expanded to Western Eurasia and Central, Western and Southern Africa from the time of their emergence. While early expansions to Eurasia appear not to have persisted,[34][20] expansions to Southern and Central Africa resulted in the deepest temporal divergence in living human populations. Early modern human expansion in sub-Saharan Africa appears to have contributed to the end of late Acheulean (Fauresmith) industries at about 130,000 years ago, although very late coexistence of archaic and early modern humans, until as late as 12,000 years ago, has been argued for West Africa in particular.[35]

The ancestors of the modern Khoi-San expanded to Southern Africa before 150,000 years ago, possibly as early as before 260,000 years ago,[note 5] so that by the beginning of the MIS 5 "megadrought", 130,000 years ago, there were two ancestral population clusters in Africa, bearers of mt-DNA haplogroup L0 in southern Africa, ancestral to the Khoi-San, and bearers of haplogroup L1-6 in central/eastern Africa, ancestral to everyone else. There was a significant back-migration of bearers of L0 towards eastern Africa between 120 and 75 kya.[note 6]

Expansion to Central Africa by the ancestors of the Central African forager populations (African Pygmies) most likely took place before 130,000 years ago, and certainly before 60,000 years ago.[37][38][39][40][note 7]

The situation in West Africa is difficult to interpret due to a sparsity of fossil evidence. *Homo sapiens* seems to have reached the western Sahelian zone by 130,000 years ago, while tropical West African sites associated with *H. sapiens* are known only from after 130,000 years ago. Unlike elsewhere in Africa, archaic Middle Stone Age sites appear to persist until very late, down to the Holocene boundary (12,000 years ago), pointing to the possibility of late survival of archaic humans, and late hybridization with *H. sapiens* in West Africa.[35]

Early northern Africa dispersal

Overview map of the peopling of the world by early modern humans (numbers indicate dates in thousands of years ago [ka])

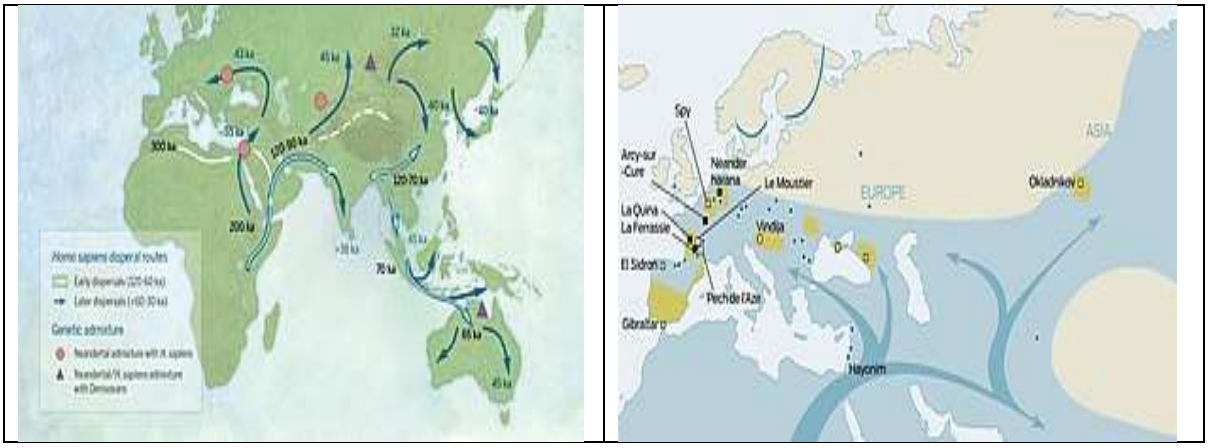
Populations of *Homo sapiens* migrated to the Levant and to Europe[*dubious* – *discuss*] between 130,000 and 115,000 years ago, and possibly in earlier waves as early as 185,000 years ago.[note 8]

A fragment of a jawbone with eight teeth found at Misliya Cave has been dated to around 185,000 years ago. Layers dating from between 250,000 and 140,000 years ago in the same cave contained tools of the Levallois type which could put the date of the first migration even earlier if the tools can be associated with the modern human jawbone finds.[42][43]

These early migrations do not appear to have led to lasting colonisation and receded by about 80,000 years ago.[20] There is a possibility that this first wave of expansion may have reached China (or even North America[*dubious* – *discuss*][44]) as early as 125,000 years ago, but would have died out without leaving a trace in the genome of contemporary humans.[20]

There is some evidence that modern humans left Africa at least 125,000 years ago using two different routes: through the Nile Valley heading to the Middle East, at least into modern Israel (Qafzeh: 120,000–100,000 years ago); and a second route through the present-day Bab-el-Mandeb Strait on the Red Sea (at that time, with a much lower sea level and narrower extension), crossing to the Arabian Peninsula[45][46] and settling in places like the present-day United Arab Emirates (125,000 years ago)[47] and Oman (106,000 years ago),[48] and possibly reaching the Indian Subcontinent (Jwalapuram: 75,000 years ago.) Although no human remains have yet been found in these three places, the apparent similarities between the stone tools found at Jebel Faya, those from Jwalapuram and some from Africa suggest that their creators were all modern humans.[49] These findings might give some support to the claim that modern humans from Africa arrived at southern China about 100,000 years ago (Zhiren Cave, Zhirendong, Chongzuo City: 100,000 years ago;[note 9] and the Liujiang hominid (Liujiang County): controversially dated at 139,000–111,000 years ago [54]). Dating results of the Lunadong (Bubing Basin, Guangxi, southern China) teeth, which include a right upper second molar and a left lower second molar, indicate that the molars may be as old as 126,000 years.[55][56]

Homo sapiens dağılımı



Şekil 6: Burada dikkati çeken 3 yol vardır. Kafkas üzerinden, Avrupa, Hazar boyunca Orta Asya ve Hindistan boyutu ile Çin ve Okyanusya'ya yayılmaktadır. Diğer görüş, Filistin'den üç kol ayrılmaktadır.

Since these previous exits from Africa did not leave traces in the results of genetic analyses based on the Y chromosome and on MtDNA (which represent only a small part of the human genetic material), it seems that those modern humans did not survive in large numbers and were assimilated by our major antecessors. An explanation for their extinction (or small genetic imprint) may be the Toba eruption (74,000 years ago), though some argue it scarcely affected human population.[57]

Coastal migration

The so-called "recent dispersal" of modern humans took place about 70–50,000 years ago.[58][59][60] It is this migration wave that led to the lasting spread of modern humans throughout the world.

A small group from a population in East Africa, bearing mitochondrial haplogroup L3 and numbering possibly fewer than 1,000 individuals,[61][62] crossed the Red Sea strait at Bab-el-Mandeb, to what is now Yemen, after around 75,000 years ago.[63] A recent review has also shown support for the northern route through Sinai/Israel/Syria (Levant).[20] Their descendants spread along the coastal route around Arabia and Persia to the Indian subcontinent before 55,000 years ago. Other research supports a migration out of Africa between about 65,000 and 50,000 years ago.[58][64][60] The coastal migration between roughly 70,000 and 50,000 years ago is associated with mitochondrial haplogroups M and N, both derivative of L3.

Along the way *H. sapiens* interbred with Neanderthals and Denisovans,[65] with Denisovan DNA making 0.2% of mainland Asian and Native American DNA.[66]

Nearby Oceania

Migrations continued along the Asian coast to Southeast Asia and Oceania, colonising Australia by around 65,000–50,000 years ago.[67][68][69] By reaching Australia, *H. sapiens* for the first time expanded its habitat beyond that of *H. erectus*. Denisovan ancestry is shared by Melanesians, Aboriginal Australians, and smaller scattered groups of people in Southeast Asia, such as the Mamanwa, a Negrito people in the Philippines, suggesting the interbreeding took place in Eastern Asia where the Denisovans lived.[70][71][72] Denisovans may have crossed the Wallace Line, with Wallacea serving as their last refugium.[73][74] *Homo erectus* had crossed the Lombok gap reaching as far as Flores, but never made it to Australia.[75]

During this time sea level was much lower and most of Maritime Southeast Asia formed one land mass known as Sunda. Migration continued Southeast on the coastal route to the straits between Sunda and Sahul, the continental land mass of present-day Australia and New Guinea. The gaps on the Weber Line are up to 90 km wide,[76] so the migration to Australia and New Guinea would have required seafaring skills. Migration also continued along the coast eventually turning northeast to China and finally reaching Japan before turning inland. This is evidenced by the pattern of mitochondrial haplogroups descended from haplogroup M, and in Y-chromosome haplogroup C.

Sequencing of one Aboriginal genome from an old hair sample in Western Australia revealed that the individual was descended from people who migrated into East Asia between 62,000 and 75,000 years ago. This supports the

theory of a single migration into Australia and New Guinea before the arrival of Modern Asians (between 25,000 and 38,000 years ago) and their later migration into North America.[77] This migration is believed to have happened around 50,000 years ago, before Australia and New Guinea were separated by rising sea levels approximately 8,000 years ago.[78][79] This is supported by a date of 50,000–60,000 years ago for the oldest evidence of settlement in Australia,[67][80] around 40,000 years ago for the oldest human remains,[67] the earliest humans artifacts which are at least 65,000 years old[81] and the extinction of the Australian megafauna by humans between 46,000 and 15,000 years ago argued by Tim Flannery,[82] which is similar to what happened in the Americas. The continued use of Stone Age tools in Australia has been much debated.[83]

Dispersal throughout Eurasia

The population brought to South Asia by coastal migration appears to have remained there for some time, during roughly 60,000 to 50,000 years ago, before spreading further throughout Eurasia. This dispersal of early humans, at the beginning of the Upper Paleolithic, gave rise to the major population groups of the Old World and the Americas.

Towards the West, Upper Paleolithic populations associated with mitochondrial haplogroup R and its derivatives, spread throughout Asia and Europe, with a back-migration of M1 to North Africa and the Horn of Africa several millennia ago.[*dubious – discuss*]

Presence in Europe is certain after 40,000 years ago, possibly as early as 43,000 years ago,[84] rapidly replacing the Neanderthal population. Contemporary Europeans have Neanderthal ancestry, but it seems likely that substantial interbreeding with Neanderthals ceased before 47,000 years ago, i.e. took place before modern humans entered Europe.[85]

There is evidence from mitochondrial DNA that modern humans have passed through at least one genetic bottleneck, in which genome diversity was drastically reduced. Henry Harpending has proposed that humans spread from a geographically restricted area about 100,000 years ago, the passage through the geographic bottleneck and then with a dramatic growth amongst geographically dispersed populations about 50,000 years ago, beginning first in Africa and thence spreading elsewhere.[86] Climatological and geological evidence suggests evidence for the bottleneck. The explosion of Toba, the largest volcanic eruption of the Quaternary, may have created a 1,000 year cold period, potentially reducing human populations to a few tropical refugia. It has been estimated that as few as 15,000 humans survived. In such circumstances genetic drift and founder effects may have been maximised. The greater diversity amongst African genomes may reflect the extent of African refugia during the Toba incident.[87] However, a recent review highlights that the single-source hypothesis of non-African populations is less consistent with ancient DNA analysis than multiple sources with genetic mixing across Eurasia.[20]

Europe

The recent expansion of anatomically modern humans reached Europe around 40,000 years ago from Central Asia and the Middle East, as a result of cultural adaption to big game hunting of sub-glacial steppe fauna.[88] Neanderthals were present both in the Middle East and in Europe, and the arriving populations of anatomically modern humans (also known as "Cro-Magnon" or European early modern humans) interbred with Neanderthal populations to a limited degree. Populations of modern humans and Neanderthal overlapped in various regions such as the Iberian Peninsula and the Middle East. Interbreeding may have contributed Neanderthal genes to Palaeolithic and ultimately modern Eurasians and Oceanians.

An important difference between Europe and other parts of the inhabited world was the northern latitude. Archaeological evidence suggests humans, whether Neanderthal or Cro-Magnon, reached sites in Arctic Russia by 40,000 years ago.[89]

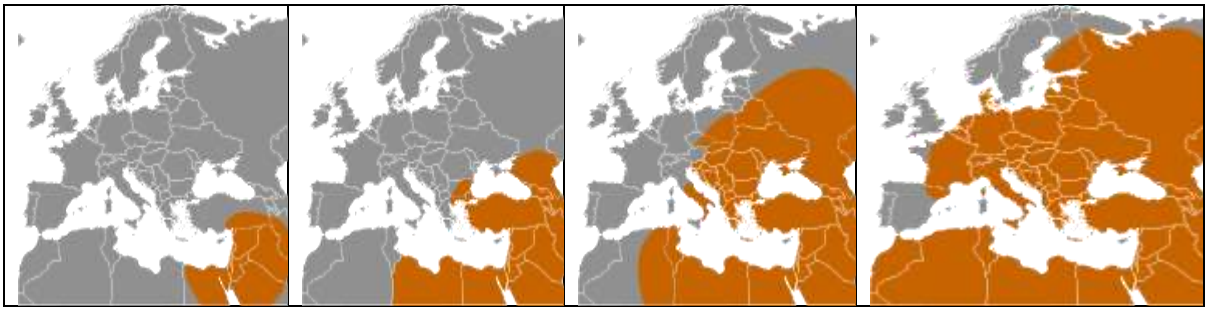
Cro-Magnon are considered the first anatomically modern humans in Europe. They entered Eurasia by the Zagros Mountains (near present-day Iran and eastern Turkey) around 50,000 years ago, with one group rapidly settling coastal areas around the Indian Ocean and another migrating north to the steppes of Central Asia.[90] Modern human remains dating to 43,000–45,000 years ago have been discovered in Italy[91] and Britain,[92] as well as in the European Russian Arctic from 40,000 years ago.[89][93]

Humans colonised the environment west of the Urals, hunting reindeer especially,[94] but were faced with adaptive challenges; winter temperatures averaged from −20 to −30 °C (−4 to −22 °F) with fuel and shelter scarce. They travelled on foot and relied on hunting highly mobile herds for food. These challenges were overcome through technological innovations: tailored clothing from the pelts of fur-bearing animals; construction of shelters with hearths using bones as fuel; and digging "ice cellars" into the permafrost to store meat and bones.[94][95]

A mitochondrial DNA sequence of two Cro-Magnons from the Paglicci Cave in Italy, dated to 23,000 and 24,000 years old (Paglicci 52 and 12), identified the mtDNA as Haplogroup N, typical of the latter group.[96]

Migration of modern humans into Europe, based on simulation by Currat & Excoffier (2004)[97] **(YBP = Years before present)**

Homo sapiens'in yıllara göre dağılımı



Şekil 7: Zamanla: 37,500, 35,000, 32,000, 30,000 yıllarında gözlenen göç boyutu.

The expansion of modern human population is thought to have begun 45,000 years ago, and it may have taken 15,000–20,000 years for Europe to be colonized.[98][99]

During this time, the Neanderthals were slowly being displaced. Because it took so long for Europe to be occupied, it appears that humans and Neanderthals may have been constantly competing for territory. The Neanderthals had larger brains, and were larger overall, with a more robust or heavily built frame, which suggests that they were physically stronger than modern *Homo sapiens*. Having lived in Europe for 200,000 years, they would have been better adapted to the cold weather. The anatomically modern humans known as the Cro-Magnons, with widespread trade networks, superior technology and bodies likely better suited to running, would eventually completely displace the Neanderthals, whose last refuge was in the Iberian peninsula. After about 25,000 years ago the fossil record of the Neanderthals ends, indicating extinction. The last known population lived around a cave system on the remote south-facing coast of Gibraltar from 30,000 to 24,000 years ago.

From the extent of linkage disequilibrium, it was estimated that the last Neanderthal gene flow into early ancestors of Europeans occurred 47,000–65,000 years BP. In conjunction with archaeological and fossil evidence, interbreeding is thought to have occurred somewhere in Western Eurasia, possibly the Middle East.[85] Studies show a higher Neanderthal admixture in East Asians than in Europeans.[100][101] North African groups share a similar excess of derived alleles with Neanderthals as non-African populations, whereas Sub-Saharan African groups are the only modern human populations with no substantial Neanderthal admixture.[note 10] The Neanderthal-linked haplotype B006 of the dystrophin gene has also been found among nomadic pastoralist groups in the Sahel and Horn of Africa, who are associated with northern populations. Consequently, the presence of this B006 haplotype on the northern and northeastern perimeter of Sub-Saharan Africa is attributed to gene flow from a non-African point of origin.[note 11]

East, Southeast and North Asia

Ancient North Eurasian populations from Siberia were an important genetic contributor to Ancient Native Americans and Eastern European Hunter-Gatherers. Neolithic Iranian farmers and Jōmon people (ancestors of the Ainu people) also received geneflow from ANE-related populations.[104]

"Tianyuan man", an individual who lived in China c. 40,000 years ago, showed substantial Neanderthal admixture. A 2017 study of the ancient DNA of Tianyuan Man found that the individual is related to modern Asian and Native American populations.[105] A 2013 study found Neanderthal introgression of 18 genes within the chromosome 3p21.31 region (HYAL region) of East Asians. The introgressive haplotypes were positively selected in only East Asian populations, rising steadily from 45,000 years ago until a sudden increase of growth rate around 5,000 to 3,500 years ago. They occur at very high frequencies among East Asian populations in contrast to other Eurasian populations (e.g., European and South Asian populations). The findings also suggest that this Neanderthal introgression occurred within the ancestral population shared by East Asians and Native Americans.[106]

A 2016 study presented an analysis of the population genetics of the Ainu people of northern Japan as key to the reconstruction of the early peopling of East Asia. The Ainu were found to represent a more basal branch than the modern farming populations of East Asia, suggesting an ancient (pre-Neolithic) connection with northeast

Siberians.[107] A 2013 study associated several phenotypical traits associated with Mongoloids with a single mutation of the EDAR gene, dated to c. 35,000 years ago.[note 12][note 13]

Further information: Ancient North Eurasians

Mitochondrial haplogroups A, B and G originated about 50,000 years ago, and bearers subsequently colonized Siberia, Korea and Japan, by about 35,000 years ago. Parts of these populations migrated to North America during the Last Glacial Maximum.

Homo sapiens dağılımı

Şekil 8: Orta Asya'da kümelenme görülmekte, bir kol buzla kaplı 92 kilometre uzunluğundaki Bering Boğazından geçerek Amerikan yerlileri oluşmaktadır.

A review paper by Melinda A. Yang (in 2022) summarized and concluded that a distinctive "Basal-East Asian population" referred to as '*East- and Southeast Asian lineage*' (ESEA); which is ancestral to modern East Asians, Southeast Asians, Polynesians, and Siberians, originated in Mainland Southeast Asia at ~50,000BC, and expanded through multiple migration waves southwards and northwards respectively. This ESEA lineage gave rise to various sub lineages, and is also ancestral to the Hoabinhian hunter-gatherers of Southeast Asia and the ~40,000 year old Tianyuan lineage found in Northern China, but already differentiated and distinct from European-related and Australasian-related lineages, found in other regions of prehistoric Eurasia. The ESEA lineage trifurcated from an earlier East-Eurasian or "eastern non-African" (ENA) meta-population, which also contributed to the formation of Ancient Ancestral South Indians (AASI) as well as to Australasians.[111]

Last Glacial Maximum

Eurasia

Schematic illustration of the Beringia migration based on matrilineal genetics: Arrival of Central Asian populations to the Beringian Mammoth steppe c. 25,000 years ago, followed by a "swift peoplling of the Americas"[*citation needed*] c. 15,000 years ago.

Around 20,000 years ago, approximately 5,000 years after the Neanderthal extinction, the Last Glacial Maximum forced northern hemisphere inhabitants to migrate to several shelters (refugia) until the end of this period. The resulting populations are presumed to have resided in such refuges during the LGM to ultimately reoccupy Europe, where archaic historical populations are considered their descendants. The composition of European populations was later altered by further migrations, notably the Neolithic expansion from the Middle East, and still later the Chalcolithic population movements associated with Indo-European expansion. A Paleolithic site on the Yana River, Siberia, at 71°N, lies well above the Arctic Circle and dates to 27,000 radiocarbon years before present, during glacial times. This site shows that people adapted to this harsh, high-latitude, Late Pleistocene environment much earlier than previously thought.[112]

Americas

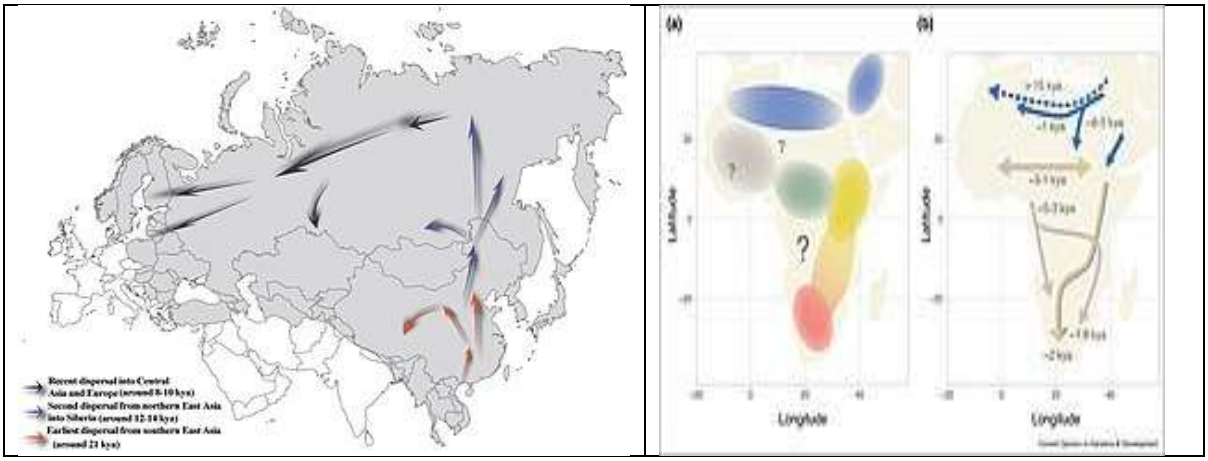
Paleo-Indians originated from Central Asia, crossing the Beringia land bridge between eastern Siberia and present-day Alaska.[113] Humans lived throughout the Americas by the end of the last glacial period, or more specifically what is known as the late glacial maximum.[113][114][115][116] Details of Paleo-Indian migration to and throughout the American continent, including the dates and the routes traveled, are subject to ongoing research and discussion.[117]

Conventional estimates have it that humans reached North America at some point between 15,000 and 20,000 years ago.[118][119][120][121] The traditional theory is that these early migrants moved when sea levels were

significantly lowered due to the Quaternary glaciation,[114][117] following herds of now-extinct pleistocene megafauna along *ice-free corridors* that stretched between the Laurentide and Cordilleran ice sheets.[122] Another route proposed is that, either on foot or using primitive boats, they migrated down the Pacific coast to South America as far as Chile.[123] Any archaeological evidence of coastal occupation during the last Ice Age would now have been covered by the sea level rise, up to a hundred metres since then.[124] The recent finding of indigenous Australasian genetic markers in Amazonia supports that a coastal route and subsequent isolation did occur with some migrants.[125]

Holocene migrations

Homo sapiensin Orta Asya ve Afrika'da kümeleşme ve kıta içindeki göçleri



Şekil 9: Afrika kabilelerde kümeleşme olduğu için, cüce pigmeler yanında uzun boylular da vardır. Beden ve bacak boyları Afrika kökenlilerde, bacaklar belirgin uzundur (1,7 kat). Orta Asya'da birebire yakındır.

Prehistoric migration routes for Y-chromosome Haplogroup N lineage following the retreat of ice sheets after the Last Glacial Maximum (22–18 kya).[126]

The Holocene is taken to begin 12,000 years ago, after the end of the Last Glacial Maximum. During the Holocene climatic optimum, beginning about 9,000 years ago, human populations which had been geographically confined to refugia began to migrate. By this time, most parts of the globe had been settled by *H. sapiens*; however, large areas that had been covered by glaciers were now re-populated.

This period sees the transition from the Mesolithic to the Neolithic stage throughout the temperate zone. The Neolithic subsequently gives way to the Bronze Age in Old World cultures and the gradual emergence of the historical record in the Near East and China beginning around 4,000 years ago.

Large-scale migrations of the Mesolithic to Neolithic era are thought to have given rise to the pre-modern distribution of the world's major language families such as the Niger-Congo, Nilo-Saharan, Afro-Asiatic, Uralic, Sino-Tibetan or Indo-European phyla. The speculative Nostratic theory postulates the derivation of the major language families of Eurasia (excluding Sino-Tibetan) from a single proto-language spoken at the beginning of the Holocene period.

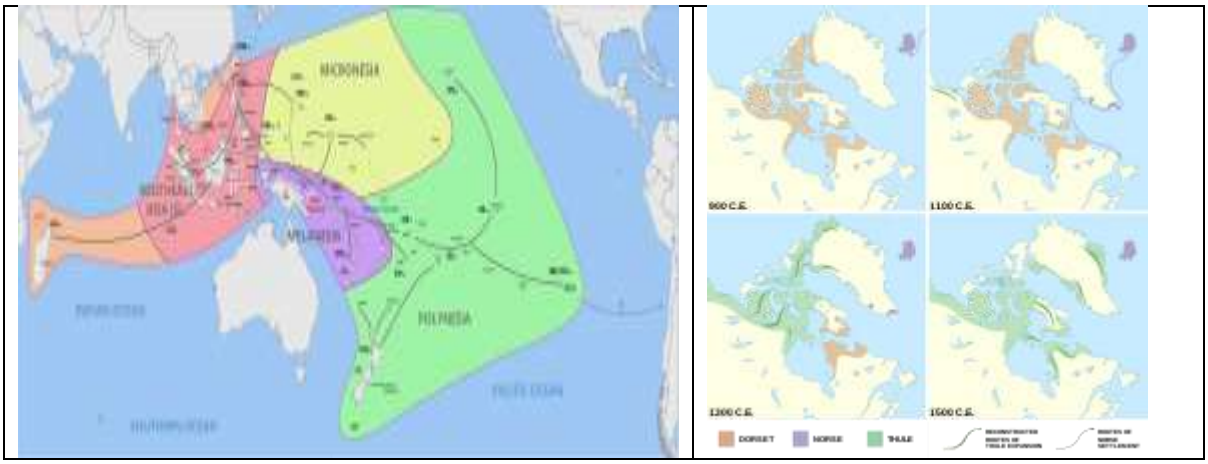
Eurasia

Evidence published in 2014 from genome analysis of ancient human remains suggests that the modern native populations of Europe largely descend from three distinct lineages: "Western Hunter-Gatherers", derivative of the Cro-Magnon population of Europe, Early European Farmers introduced to Europe from the Near East during the Neolithic Revolution and Ancient North Eurasians who expanded to Europe in the context of the Indo-European expansion.[127] The Ancient North Eurasian component was introduced to Western Europe by people related to the Yamnaya culture.[128] Additional ANE ancestry is found in European populations through Paleolithic interactions with Eastern Hunter-Gatherers.[129]

Sub-Saharan Africa

West-Eurasian back-migrations started in the early Holocene or already earlier in the Paleolithic period (30-15kya),followed by pre-Neolithic and Neolithic migration events from the Middle East, mostly affecting Northern Africa, the Horn of Africa, and wider regions of the Sahel zone and East Africa.[130]
Pre-Neolithic and Neolithic migration events in Africa.[131]
The Nilotic peoples are thought to be derived from an earlier undifferentiated Eastern Sudanic unity by the 3rd millennium BCE. The development of the Proto-Nilotes as a group may have been connected with their domestication of livestock. The Eastern Sudanic unity must have been considerably earlier still, perhaps around the 5th millennium BCE (while the proposed Nilo-Saharan unity would date to the Upper Paleolithic about 15kya). The original locus of the early Nilotic speakers was presumably east of the Nile in what is now South Sudan. The Proto-Nilotes of the 3rd millennium BCE were pastoralists, while their neighbors, the Proto-Central Sudanic peoples, were mostly agriculturalists.[132]
The Niger-Congo phylum is thought to have emerged around 6,000 years ago in West or Central Africa. Its expansion may have been associated with the expansion of Sahel agriculture in the African Neolithic period, following the desiccation of the Sahara in c. 3900 BCE.[133] The Bantu expansion has spread the Bantu languages to Central, Eastern and Southern Africa, partly replacing the indigenous populations of these regions, including the African Pygmies, Hadza people and San people. Beginning about 3,000 years ago, it reached South Africa about 1,700 years ago.[134]
Some evidence (including a 2016 study by Busby et al.) suggests admixture from ancient and recent migrations from Eurasia into parts of Sub-Saharan Africa.[135] Another study (Ramsay et al. 2018) also shows evidence that ancient Eurasians migrated into Africa and that Eurasian admixture in modern Sub-Saharan Africans ranges from 0% to 50%, varying by region and generally higher in the Horn of Africa and parts of the Sahel zone, and found to a lesser degree in certain parts of Western Africa, and Southern Africa (excluding recent immigrants).[136]
Indo-Pacific

Homo sapiens Okyanusya ve Kutuplardaki dağılımı



Şekil 10: Adalarda kümelenme ve birbirleri ile evlenme sonucunda tek tip yapıda insanların olması doğal karşılanmalıdır.

Chronological map of the Austronesian expansion
The first seaborne human migrations were by the Austronesian peoples[*dubious – discuss*] originating from Taiwan known as the "Austronesian expansion".[137] Using advanced sailing technologies like catamarans, outrigger boats, and crab claw sails, they built the first sea-going ships and rapidly colonized Island Southeast Asia at around 3000 to 1500 BCE. From the Philippines and Eastern Indonesia they colonized Micronesia by 2200 to 1000 BCE.[137][138]
A branch of the Austronesians reached Island Melanesia between 1600 and 1000 BCE, establishing the Lapita culture (named after the archaeological site in Lapita, New Caledonia, where their characteristic pottery was first discovered). They are the direct ancestors of the modern Polynesians. They ventured into Remote Oceania reaching Vanuatu, New Caledonia, and Fiji by 1200 BCE, and Samoa and Tonga by around 900 to 800 BCE. This was the furthest extent of the Lapita culture expansion. During a period of around 1,500 years, they

gradually lost the technology for pottery (likely due to the lack of clay deposits in the islands), replacing it with carved wooden and bamboo containers. Back-migrations from the Lapita culture also merged back Island Southeast Asia in 1500 BCE, and into Micronesia at around 200 BCE. It was not until 700 CE when they started voyaging further into the Pacific Ocean, when they colonized the Cook Islands, the Society Islands, and the Marquesas. From there, they further colonized Hawaii by 900 CE, Rapa Nui by 1000 CE, and New Zealand by 1200 CE.[138][139][140]

In the Indian Ocean, Austronesians from Borneo also colonized Madagascar and the Comoros Islands by around 500 CE. Austronesians remain the dominant ethnolinguistic group of the islands of the Indo-Pacific, and were the first to establish a maritime trade network reaching as far west as East Africa and the Arabian peninsula. They assimilated earlier Pleistocene to early Holocene human overland migrations through Sundaland like the Papuans and the Negritos in Island Southeast Asia.[137][138] The Austronesian expansion was the last and the most far-reaching Neolithic human migration event.[141]

Caribbean

The Caribbean was one of the last places in the Americas that were settled by humans. The oldest remains are known from the Greater Antilles (Cuba and Hispaniola) dating between 4000 and 3500 BCE, and comparisons between tool-technologies suggest that these peoples moved across the Yucatán Channel from Central America. All evidence suggests that later migrants from 2000 BCE and onwards originated from South America, via the Orinoco region.[142] The descendants of these migrants include the ancestors of the Taíno and Kalinago (Island Carib) peoples.[143]

Arctic

The earliest inhabitants of North America's central and eastern Arctic are referred to as the Arctic small tool tradition (AST) and existed c. 2500 BCE. AST consisted of several Paleo-Eskimo cultures, including the Independence cultures and Pre-Dorset culture.[144][145]

The Inuit are the descendants of the Thule culture, which emerged from western Alaska around CE 1000 and gradually displaced the Dorset culture.[146][147]

Yorum

Bu Makalenin amacı, İnsanların yerleşimleri değil, sadece kardeşlik bağı ile bağlı tek tür olduğu ifadesidir.

Tüm Makalenin verilmesi bilgi edinilmesi içindir.

Upper Paleolithic, Wikipedia[5]

The **Upper Paleolithic** (or **Upper Palaeolithic**) is the third and last subdivision of the Paleolithic or Old Stone Age. Very broadly, it dates to between 50,000 and 12,000 years ago (the beginning of the Holocene), according to some theories coinciding with the appearance of behavioral modernity in early modern humans,[1] until the advent of the Neolithic Revolution and agriculture.

Anatomically modern humans (i.e., *Homo sapiens*) are believed to have emerged in Africa around 300,000 years ago. It has been argued by some that their ways of life changed relatively little from that of archaic humans of the Middle Paleolithic,[2] until about 50,000 years ago, when there was a marked increase in the diversity of artefacts found associated with modern human remains. This period coincides with the most common date assigned to expansion of modern humans from Africa throughout Asia and Eurasia, which contributed to the extinction of the Neanderthals.

The Upper Paleolithic has the earliest known evidence of organized settlements, in the form of campsites, some with storage pits. Artistic work blossomed, with cave painting, petroglyphs, carvings and engravings on bone or ivory. The first evidence of human fishing is also found, from artefacts in places such as Blombos cave in South Africa. More complex social groupings emerged, supported by more varied and reliable food sources and specialized tool types. This probably contributed to increasing group identification or ethnicity.[3]

The peopling of Australia most likely took place before c. 60 ka. Europe was peopled after c. 45 ka. Anatomically modern humans are known to have expanded northward into Siberia as far as the 58th parallel by about 45 ka (Ust'-Ishim man). The Upper Paleolithic is divided by the Last Glacial Maximum (LGM), from about 25 to 15 ka. The peopling of the Americas occurred during this time, with East and Central Asia populations reaching the Bering land bridge after about 35 ka, and expanding into the Americas by about 15 ka. In Western Eurasia, the Paleolithic eases into the so-called Epipaleolithic or Mesolithic from the end of the LGM, beginning 15 ka.

The Holocene glacial retreat begins 11.7 ka (10th millennium BC), falling well into the Old World Epipaleolithic, and marking the beginning of the earliest forms of farming in the Fertile Crescent.

Lifestyle and technology

Both *Homo erectus* and Neanderthals used the same crude stone tools. Archaeologist Richard G. Klein, who has worked extensively on ancient stone tools, describes the stone tool kit of archaic hominids as impossible to categorize. He argues that almost everywhere, whether Asia, Africa or Europe, before 50,000 years ago all the stone tools are much alike and unsophisticated.

Firstly, among the artefacts of Africa, archeologists found they could differentiate and classify those of less than 50,000 years into many different categories, such as projectile points, engraving tools, knife blades, and drilling and piercing tools. These new stone-tool types have been described as being distinctly differentiated from each other; each tool had a specific purpose. The early modern humans who expanded into Europe, commonly referred to as the Cro-Magnons, left many sophisticated stone tools, carved and engraved pieces on bone, ivory and antler, cave paintings and Venus figurines.[4][5][1]

The Neanderthals continued to use Mousterian stone tool technology and possibly Châtelperronian technology. These tools disappeared from the archeological record at around the same time the Neanderthals themselves disappeared from the fossil record, about 40,000 cal BP.[6]

Settlements were often located in narrow valley bottoms, possibly associated with hunting of passing herds of animals. Some of them may have been occupied year-round, though more commonly they appear to have been used seasonally; people moved between the sites to exploit different food sources at different times of the year. Hunting was important, and caribou/wild reindeer "may well be the species of single greatest importance in the entire anthropological literature on hunting".[7]

Technological advances included significant developments in flint tool manufacturing, with industries based on fine blades rather than simpler and shorter flakes. Burins and racloirs were used to work bone, antler and hides. Advanced darts and harpoons also appear in this period, along with the fish hook, the oil lamp, rope, and the eyed needle. Fishing of pelagic fish species and navigating the open ocean is evidenced by sites from Timor and Buka (Solomon Islands).

The changes in human behavior have been attributed to changes in climate, encompassing a number of global temperature drops. These led to a worsening of the already bitter cold of the last glacial period (popularly but incorrectly called the last ice age). Such changes may have reduced the supply of usable timber and forced people to look at other materials. In addition, flint becomes brittle at low temperatures and may not have functioned as a tool.

Notational signs

Some notational signs, used next to images of animals, may have appeared as early as the Upper Palaeolithic in Europe circa 35,000 BCE, and may be the earliest proto-writing: several symbols were used in combination as a way to convey seasonal behavioural information about hunted animals.[8] Lines (|) and dots (•) were apparently used interchangeably to denote lunar months, while the (Y) sign apparently signified "To give birth". These characters were seemingly combined to convey the breeding period of hunted animals.[8]

Changes in climate and geography

The climate of the period in Europe saw dramatic changes, and included the Last Glacial Maximum, the coldest phase of the last glacial period, which lasted from about 26.5 to 19 kya, being coldest at the end, before relatively rapid warming (all dates vary somewhat for different areas, and in different studies). During the Maximum, most of Northern Europe was covered by an ice-sheet, forcing human populations into the areas known as Last Glacial Maximum refugia, including modern Italy and the Balkans, parts of the Iberian Peninsula and areas around the Black Sea.

This period saw cultures such as the Solutrean in France and Spain. Human life may have continued on top of the ice sheet, but we know next to nothing about it, and very little about the human life that preceded the European glaciers. In the early part of the period, up to about 30 kya, the Mousterian Pluvial made northern Africa, including the Sahara, well-watered and with lower temperatures than today; after the end of the Pluvial the Sahara became arid.

The Last Glacial Maximum was followed by the Allerød oscillation, a warm and moist global interstadial that occurred around 13.5 to 13.8 kya. Then there was a very rapid onset, perhaps within as little as a decade, of the cold and dry Younger Dryas climate period, giving sub-arctic conditions to much of northern Europe. The Preboreal rise in temperatures also began sharply around 10.3 kya, and by its end around 9.0 kya had brought temperatures nearly to present day levels, although the climate was wetter.[*citation needed*] This period saw the Upper Paleolithic give way to the start of the following Mesolithic cultural period.

As the glaciers receded sea levels rose; the English Channel, Irish Sea and North Sea were land at this time, and the Black Sea a fresh-water lake. In particular the Atlantic coastline was initially far out to sea in modern terms in most areas, though the Mediterranean coastline has retreated far less, except in the north of the Adriatic and the Aegean. The rise in sea levels continued until at least 7.5 kya (5500 BC), so evidence of human activity along Europe's coasts in the Upper Paleolithic is mostly lost, though some traces have been recovered by fishing boats and marine archaeology, especially from Doggerland, the lost area beneath the North Sea.[*citation needed*]

Timeline

50,000 BP

- Numerous Aboriginal stone tools were found in gravel sediments in Castlereagh, Sydney, Australia. At first when these results were new they were controversial; more recently dating of the same strata has revised and corroborated these dates.[11][12]
- Start of the Mousterian Pluvial in North Africa.
- Occupants of the Fa-Hien Lena cave, Sri Lanka had developed bow and arrow technology 48,000 BP (though the earliest known bow and arrow technology dates to about 65,000 BP from Sibudu Cave, South Africa[13][14][15][16]).

45,000–43,000 BP

- Earliest evidence of modern humans found in Europe, in Southern Italy.[17] These are indirectly dated.[18]
- Earliest mathematical artifact, the notched Lebombo bone, a possible tally stick or lunar calendar, dated to 44,000–43,000 BP in Eswatini (Swaziland), southern Africa.[19]
- Oldest-known mining in archaeological record, the Ngwenya Mine in Swaziland, at about 43,000 years ago, where humans mined hematite to make the red pigment ochre.[20][21]
- Earliest directly dated figurative cave art of mankind at Leang Bulu' Sipong in Sulawesi, Indonesia.[22]

43,000–41,000 BP

- Ornaments and skeletal remains of modern humans, at Ksar Akil in Lebanon. These are directly dated.[18]
- Denisova hominins live in the Altai Mountains (Russia, China, Mongolia, and Kazakhstan).

40,000–30,000 BP

40,000–35,000 BP

- First human inhabitants in Perth, Australia, as evidenced by archaeological findings on the Upper Swan River.[23]
- During this time period, Melbourne, Australia was occupied by hunter-gatherers.[24][25]
- Early cultural centre in the Swabian Alps, oldest depiction of a human being (Venus of Hohle Fels), beginning of the Aurignacian.
- *Löwenmensch* figure created in Hohlenstein-Stadel, one of the earliest figurative art. It is now in Ulmer Museum, Ulm, Germany.
- The first flutes appear in Germany.
- Notational signs in caves, apparently conveying calendaric meaning about the behaviour of animal species drawn next to them, are the first known (proto-)writing in history *(see above)*.[26][8]
- Most of the giant vertebrates and megafauna in Australia became extinct.
- Fishing of pelagic fish species at Jerimalai shelter, Timor.Venus of Dolní Věstonice, the oldest surviving ceramic figurine in the world (29,000 – 25,000 BC)
- Examples of cave art in Spain are dated from around 40,000 BP, making them the oldest examples of cave art yet discovered in Europe (see: Caves of Nerja). Scientists theorise that the paintings may have been made by Neanderthals, rather than by modern humans.[27][28]
- Wall painting with horses, rhinoceroses and aurochs is made at Chauvet Cave, Vallon-Pont-d'Arc, Ardéche gorge, France. Discovered in December 1994.
- Evidence for continued Neanderthal presence in the Iberian Peninsula at 37,000 years ago was published in 2017.[29]
- Archaeological studies support human presence in the Chek Lap Kok area (now Hong Kong International Airport) from 35,000 to 39,000 years ago.[30]
- Zar, Yataghyeri, Damjili and Taghlar caves in Azerbaijan.
- First evidence of people inhabiting Japan.[31]

35,000 BP

- Kostenki XVII, a layer of the Kostenki (Kostyonki) site, on the middle Don River, was occupied by the early upper paleolithic Spitsyn culture.

30,000 BP

- First ground stone tools appear in Japan.[32]
- End of the Mousterian Pluvial in North Africa.
- The area of Sydney was occupied by Aboriginal Australians (specifically, the Eora and Dharug people) during this time period, as evidenced by radiocarbon dating.[33] In an archaeological dig in Parramatta, Western Sydney, it was found that the Aboriginals used charcoal, stone tools and possible ancient campfires.[34]
- First human settlement in Alice Springs, Northern Territory, Australia.[35]
- Kilu Cave at Buka in the Solomons is evidence for the first human settlement of an oceanic island and for navigating the open ocean.

30,000–20,000 BP

29,000–25,000 BP

- Eruption of the Ciomad volcano, the last volcanic eruption in the Carpathians.
- Venus of Dolní Věstonice (Czech Republic). It is the oldest known ceramic in the world.
- Venus of Willendorf, Austria, created. It is now at the Natural History Museum, Vienna.
- The Red Lady of Paviland lived around 29,000–26,000 years ago. Recent evidence has come to light that he was a tribal chief.[*citation needed*]
- Human settlement in Beijing, China dates from about 27,000 to 10,000 years ago.[36]

24,000 BP

- Start of the second Mousterian Pluvial in North Africa.

23,000 BP

- Venus of Petřkovice is created at Petřkovice in Ostrava, Czech Republic. It is now in Archeological Institute, Brno.

22,000 BP

- Last Glacial Maximum: Venus of Brassempouy, Grotte du Pape, Brassempouy, Landes, France, created. It is now at Musée des Antiquités Nationales, Saint-Germain-en-Laye.

21,000 BP

- Artifacts suggests early human activity occurred at some point in Canberra, Australia.[37] Archaeological evidence of settlement in the region includes inhabited rock shelters, rock art, burial places, camps and quarry sites, and stone tools and arrangements.[38]
- End of the second Mousterian Pluvial in North Africa.

20,000–10,000 BP

- Last Glacial Maximum. Mean sea levels are believed to be 110 to 120 metres (360 to 390 ft) *lower than present*,[39] with the direct implication that many coastal and lower riverine valley archaeological sites of interest are today under water.

18,000 BP

- Spotted Horses, Pech Merle cave, Dordogne, France are painted. Discovered in December, 1994.
- Ibex-headed spear-thrower, from Le Mas-d'Azil, Ariège, France, is made. It is now at Musée de la Préhistoire, Le Mas d'Azil.
- Mammoth-bone village in Mezhyrich, Ukraine is inhabited.

17,000 BP

- Spotted human hands are painted at Pech Merle cave, Dordogne, France. Discovered in December 1994.
- Oldest Dryas stadial.
- Hall of Bulls at Lascaux in France is painted. Discovered in 1940. Closed to the public in 1963.
- Bird-Headed man with bison and Rhinoceros, Lascaux, is painted.
- Lamp with ibex design, from La Mouthe cave, Dordogne, France, is made. It is now at Musée des Antiquités Nationales, Saint-Germain-en-Laye.
- Paintings in Cosquer Cave are made, where the cave mouth is now under water at Cap Margiou, France.

15,000 BP

- Bølling interstadial.
- Bison, Le Tuc d'Audoubert, Ariège, France.
- Paleo-Indians move across North America, then southward through Central America.
- Pregnant woman and deer (?), from Laugerie-Basse, France was made. It is now at Musée des Antiquités Nationales, St.-Germain-en-Laye.

14,000 BP

- Older Dryas stadial, Allerød interstadial.
- Paleo-Indians searched for big game near what is now the Hovenweep National Monument.
- Bison, on the ceiling of a cave at Altamira, Spain, is painted. Discovered in 1879. Accepted as authentic in 1902.[*clarification needed*]
- Younger Dryas stadial.
- Beginning of the Holocene extinction.

12,000 BP

- Wooden buildings in South America (Chile).
- First pottery vessels in Japan.

11,000 BP

- First evidence of human settlement in Argentina.
- The Arlington Springs Man dies on the island of Santa Rosa, off the coast of California, United States.
- Human remains deposited in caves which are now located off the coast of Yucatán, Mexico.[40]
- Creswellian culture settlement on Hengistbury Head, England, dates from around this year.

10,000 BP

- Evidence of a massacre near Lake Turkana, Kenya indicates upper paleolithic warfare.[41]

Cultures

- The Châtelperronian culture was located around central and south western France, and northern Spain. It appears to be derived from the Mousterian culture, and represents the period of overlap between Neanderthals and *Homo sapiens*. This culture lasted from approximately 45,000 BP to 40,000 BP.[6]
- The Aurignacian culture was located in Europe and south west Asia, and flourished between 43,000 and 26,000 BP. It may have been contemporary with the Périgordian (a contested grouping of the earlier Châtelperronian and later Gravettian cultures).
- The Gravettian culture was located across Europe. Gravettian sites generally date between 33,000 and 20,000 BP.
- The Solutrean culture was located in eastern France, Spain, and England. Solutrean artifacts have been dated c. 22,000 to 17,000 BP.
- The Magdalenian culture left evidence from Portugal to Poland during the period from 17,000 to 12,000 BP.
- Central and east Europe:
  - 33,000 BP, Gravettian culture in southern Ukraine[42]
  - 30,000 BP, Szeletian culture
  - 22,000 BP, Pavlovian, Aurignacian cultures
  - 13,000 BP, Ahrensburg culture (Western Germany, Netherlands, England)
  - 12,000 BP, Epigravettian
- North and west Africa, and Sahara:
  - 32,000 BP, Aterian culture (Algeria, Libya)
  - 12,000 BP, Ibero-Maurusian (a.k.a. Oranian, Ouchtatian), and Sebilian cultures
  - 10,000 BP, Capsian culture (Tunisia, Algeria)
- Central, south, and east Africa:
  - 50,000 BP, Fauresmith culture
  - 30,000 BP, Stillbayan culture
  - 12,000 BP, Lupembian culture
  - 11,000 BP, Magosian culture (Zambia, Tanzania)
  - 9,000 BP, Wiltonian culture
- West Asia (including Middle East):
  - 50,000 BP, Jabroudian culture (Levant)
  - 40,000 BP, Amoudian culture
  - 30,000 BP, Emireh culture
  - 20,000 BP, Aurignacian culture
  - 12,000 BP, Kebarian, Athlitian cultures
- South, central and northern Asia:
  - 30,000 BP, Angara culture
  - 11,000 BP, Khandivili culture
- East and southeast Asia:
  - 30,000 BP, Sen-Doki culture

- 16,000 BP, Jōmon period starts in Ancient Japan
- 12,000 BP, pre-Jōmon ceramic culture (Japan)
- 10,000 BP, Hoabinhian culture (Northern Vietnam)
- 9,000 BP, Jōmon culture (Japan)
- Oceania:
- 40,000 BP, Whadjuk and Noongar culture (Perth, Australia)[43]
- 35,000 BP, Wurundjeri, Boonwurrung and Wathaurong culture (Melbourne, Australia)[44]
- 30,000 BP, Eora and Darug[45] culture (Sydney, Australia)[46]
- 30,000 BP, Arrernte culture (Alice Springs, Central Australia)[47]
- America:
- South American culture located in Chile and Brazil flourished between 30,000 and 20,000 BP.[48]

Yorum

Kaynakta, zaman dilimine göre insanların kökenleri ve yerleştikleri yerler sunulmuştur.

Southern Dispersal, Wikipedia[6]

In the context of the recent African origin of modern humans, the **Southern Dispersal** scenario (also the **coastal migration** or **great coastal migration** hypothesis) refers to the early migration along the southern coast of Asia, from the Arabian Peninsula via Persia and India to Southeast Asia and Oceania.[1] Alternative names include the "southern coastal route"[2] or "rapid coastal settlement",[3][4] with later descendants of those migrations eventually colonizing the rest of Eurasia, the remainder of Oceania, and the Americas.

The coastal route theory is primarily used to describe the initial peopling of West Asia, India, Southeast Asia, New Guinea, Australia, Near Oceania, and East Asia beginning between roughly 70,000 and 50,000 years ago.[4][5][6][7][8][9]

It is linked with the presence and dispersal of mtDNA haplogroup M and haplogroup N, as well as the specific distribution patterns of Y-DNA haplogroup F (ancestral to O, N, R, Q),[10] haplogroup C and haplogroup D, in these regions.[3][11][12]

The theory proposes that early modern humans, some of the bearers of mitochondrial haplogroup L3, arrived in the Arabian peninsula about 70,000-50,000 years ago, crossing from East Africa via the Bab-el-Mandeb strait.[4] It has been estimated that from a population of 2,000 to 5,000 individuals in Africa, only a small group, possibly as few as 150 to 1,000 people, crossed the Red Sea.[13] The group would have travelled along the coastal route around Arabia and Persia to India relatively rapidly, within a few thousand years. From India, they would have spread to Southeast Asia ("Sundaland") and Oceania ("Sahul").[6][7][9][4]

A review paper by Melinda A. Yang (in 2022) summarized and concluded that a distinctive "Basal-East Asian population" referred to as '*East- and Southeast Asian lineage*' (ESEA); which is ancestral to modern East Asians, Southeast Asians, Polynesians, and Siberians, originated in Mainland Southeast Asia at ~50,000BC, and expanded through multiple migration waves southwards and northwards respectively. This ESEA lineage gave rise to various sublineages, and is also ancestral to the Hoabinhian hunter-gatherers of Southeast Asia and the ~40,000 year old Tianyuan lineage found in Northern China, but already differentiated and distinct from European-related and Australasian-related lineages, found in other regions of prehistoric Eurasia. The ESEA lineage trifurcated from an earlier East-Eurasian or "eastern non-African" (ENA) meta-population, which also contributed to the formation of Ancient Ancestral South Indians (AASI) as well as to Australasians. [14]

Yorum

Afrika Bölgesinde de gruplar şeklinde kabile yaşamı oluşmuştur.

Human, Wikipedia, kalan yerden devam ediyor

Until about 12,000 years ago, all humans lived as hunter-gatherers.[44][45] The Neolithic Revolution (the invention of agriculture) first took place in Southwest Asia and spread through large parts of the Old World over the following millennia.[46] It also occurred independently in Mesoamerica (about 6,000 years ago),[47] China,[48][49] Papua New Guinea,[50] and the Sahel and West Savanna regions of Africa.[51][52][53] Access to food surplus led to the formation of permanent human settlements, the domestication of animals and the use of metal tools for the first time in history. Agriculture and sedentary lifestyle led to the emergence of early civilizations.[54][55][56]

An urban revolution took place in the 4th millennium BCE with the development of city-states, particularly Sumerian cities located in Mesopotamia.[57] It was in these cities that the earliest known form of writing, cuneiform script, appeared around 3000 BCE.[58] Other major civilizations to develop around this time were Ancient Egypt and the Indus Valley Civilisation.[59] They eventually traded with each other and invented technology such as wheels, plows and sails.[60][61][62][63] Astronomy and mathematics were also developed and the Great Pyramid of Giza was built.[64][65][66] There is evidence of a severe drought lasting about a hundred years that may have caused the decline of these civilizations,[67] with new ones appearing in the aftermath. Babylonians came to dominate Mesopotamia while others,[68] such as the Poverty Point culture, Minoans and the Shang dynasty, rose to prominence in new areas.[69][70][71] The Late Bronze Age collapse around 1200 BCE resulted in the disappearance of a number of civilizations and the beginning of the Greek Dark Ages.[72][73] During this period iron started replacing bronze, leading to the Iron Age.[74]

In the 5th century BCE, history started being recorded as a discipline, which provided a much clearer picture of life at the time.[75] Between the 8th and 6th century BCE, Europe entered the classical antiquity age, a period when ancient Greece and ancient Rome flourished.[76][77] Around this time other civilizations also came to prominence. The Maya civilization started to build cities and create complex calendars.[78][79] In Africa, the Kingdom of Aksum overtook the declining Kingdom of Kush and facilitated trade between India and the Mediterranean.[80] In West Asia, the Achaemenid Empire's system of centralized governance became the precursor to many later empires,[81] while the Gupta Empire in India and the Han dynasty in China have been described as golden ages in their respective regions.[82][83]

Following the fall of the Western Roman Empire in 476, Europe entered the Middle Ages.[84] During this period, Christianity and the Church would provide centralized authority and education.[85] In the Middle East, Islam became the prominent religion and expanded into North Africa. It led to an Islamic Golden Age, inspiring achievements in architecture, the revival of old advances in science and technology, and the formation of a distinct way of life.[86][87] The Christian and Islamic worlds would eventually clash, with the Kingdom of England, the Kingdom of France and the Holy Roman Empire declaring a series of holy wars to regain control of the Holy Land from Muslims.[88]

In the Americas, complex Mississippian societies would arise starting around 800 CE,[89] while further south, the Aztecs and Incas would become the dominant powers.[90] The Mongol Empire would conquer much of Eurasia in the 13th and 14th centuries.[91] Over this same time period, the Mali Empire in Africa grew to be the largest empire on the continent, stretching from Senegambia to Ivory Coast.[92] Oceania would see the rise of the Tu'i Tonga Empire which expanded across many islands in the South Pacific.[93]

The early modern period in Europe and the Near East (c. 1450–1800) began with the final defeat of the Byzantine Empire, and the rise of the Ottoman Empire.[94] Meanwhile, Japan entered the Edo period,[95] the Qing dynasty rose in China[96] and the Mughal Empire ruled much of India.[97] Europe underwent the Renaissance, starting in the 15th century,[98] and the Age of Discovery began with the exploring and colonizing of new regions.[99] This includes the British Empire expanding to become the world's largest empire[100] and the colonization of the Americas.[101] This expansion led to the Atlantic slave trade[102] and the genocide of Native American peoples.[103] This period also marked the Scientific Revolution, with great advances in mathematics, mechanics, astronomy and physiology.[104]

The late modern period (1800–present) saw the Technological and Industrial Revolution bring such discoveries as imaging technology, major innovations in transport and energy development.[105] The United States of America underwent great change, going from a small group of colonies to one of the global superpowers.[106] The Napoleonic Wars raged through Europe in the early 1800s,[107] Spain lost most of its colonies in the New World,[108] while Europeans continued expansion into Africa – where European control went from 10% to almost 90% in less than 50 years[109] – and Oceania.[110] A tenuous balance of power among European nations collapsed in 1914 with the outbreak of the First World War, one of the deadliest conflicts in history.[111] In the 1930s, a worldwide economic crisis led to the rise of authoritarian regimes and a Second World War, involving almost all of the world's countries.[112] Following its conclusion in 1945, the Cold War between the USSR and the United States saw a struggle for global influence, including a nuclear arms race and a space race.[113][114] The current Information Age sees the world becoming increasingly globalized and interconnected.[115]

Habitat and population

Early human settlements were dependent on proximity to water and – depending on the lifestyle – other natural resources used for subsistence, such as populations of animal prey for hunting and arable land for growing crops and grazing livestock.[119] Modern humans, however, have a great capacity for altering their habitats by means of

technology, irrigation, urban planning, construction, deforestation and desertification.[120] Human settlements continue to be vulnerable to natural disasters, especially those placed in hazardous locations and with low quality of construction.[121] Grouping and deliberate habitat alteration is often done with the goals of providing protection, accumulating comforts or material wealth, expanding the available food, improving aesthetics, increasing knowledge or enhancing the exchange of resources.[122]

Humans are one of the most adaptable species, despite having a low or narrow tolerance for many of the earth's extreme environments.[123] Through advanced tools, humans have been able to extend their tolerance to a wide variety of temperatures, humidity, and altitudes.[123] As a result, humans are a cosmopolitan species found in almost all regions of the world, including tropical rainforest, arid desert, extremely cold arctic regions, and heavily polluted cities; in comparison, most other species are confined to a few geographical areas by their limited adaptability.[124] The human population is not, however, uniformly distributed on the Earth's surface, because the population density varies from one region to another, and large stretches of surface are almost completely uninhabited, like Antarctica and vast swathes of the ocean.[123][125] Most humans (61%) live in Asia; the remainder live in the Americas (14%), Africa (14%), Europe (11%), and Oceania (0.5%).[126]

Within the last century, humans have explored challenging environments such as Antarctica, the deep sea, and outer space.[127] Human habitation within these hostile environments is restrictive and expensive, typically limited in duration, and restricted to scientific, military, or industrial expeditions.[127] Humans have briefly visited the Moon and made their presence felt on other celestial bodies through human-made robotic spacecraft.[128][129][130] Since the early 20th century, there has been continuous human presence in Antarctica through research stations and, since 2000, in space through habitation on the International Space Station.[131]

Estimates of the population at the time agriculture emerged in around 10,000 BC have ranged between 1 million and 15 million.[133][134] Around 50–60 million people lived in the combined eastern and western Roman Empire in the 4th century AD.[135] Bubonic plagues, first recorded in the 6th century AD, reduced the population by 50%, with the Black Death killing 75–200 million people in Eurasia and North Africa alone.[136] Human population is believed to have reached one billion in 1800. It has since then increased exponentially, reaching two billion in 1930 and three billion in 1960, four in 1975, five in 1987 and six billion in 1999.[137] It passed seven billion in 2011[138] and passed eight billion in November 2022.[139] It took over two million years of human prehistory and history for the human population to reach one billion and only 207 years more to grow to 7 billion.[140] The combined biomass of the carbon of all the humans on Earth in 2018 was estimated at 60 million tons, about 10 times larger than that of all non-domesticated mammals.[132]

In 2018, 4.2 billion humans (55%) lived in urban areas, up from 751 million in 1950.[141] The most urbanized regions are Northern America (82%), Latin America (81%), Europe (74%) and Oceania (68%), with Africa and Asia having nearly 90% of the world's 3.4 billion rural population.[141] Problems for humans living in cities include various forms of pollution and crime,[142] especially in inner city and suburban slums. Humans have had a dramatic effect on the environment. They are apex predators, being rarely preyed upon by other species.[143] Human population growth, industrialization, land development, overconsumption and combustion of fossil fuels have led to environmental destruction and pollution that significantly contributes to the ongoing mass extinction of other forms of life.[144][145]

Biology

Anatomy and physiology

Most aspects of human physiology are closely homologous to corresponding aspects of animal physiology. The human body consists of the legs, the torso, the arms, the neck, and the head. An adult human body consists of about 100 trillion (10^{14}) cells. The most commonly defined body systems in humans are the nervous, the cardiovascular, the digestive, the endocrine, the immune, the integumentary, the lymphatic, the musculoskeletal, the reproductive, the respiratory, and the urinary system.[146][147] The dental formula of humans is: 2.1.2.32.1.2.3. Humans have proportionately shorter palates and much smaller teeth than other primates. They are the only primates to have short, relatively flush canine teeth. Humans have characteristically crowded teeth, with gaps from lost teeth usually closing up quickly in young individuals. Humans are gradually losing their third molars, with some individuals having them congenitally absent.[148]

Humans share with chimpanzees a vestigial tail, appendix, flexible shoulder joints, grasping fingers and opposable thumbs.[149] Apart from bipedalism and brain size, humans differ from chimpanzees mostly in smelling, hearing and digesting proteins.[150] While humans have a density of hair follicles comparable to other apes, it is predominantly vellus hair, most of which is so short and wispy as to be practically invisible.[151][152] Humans have about 2 million sweat glands spread over their entire bodies, many more than

chimpanzees, whose sweat glands are scarce and are mainly located on the palm of the hand and on the soles of the feet.[153]

It is estimated that the worldwide average height for an adult human male is about 171 cm (5 ft 7 in), while the worldwide average height for adult human females is about 159 cm (5 ft 3 in).[154] Shrinkage of stature may begin in middle age in some individuals but tends to be typical in the extremely aged.[155] Throughout history, human populations have universally become taller, probably as a consequence of better nutrition, healthcare, and living conditions.[156] The average mass of an adult human is 59 kg (130 lb) for females and 77 kg (170 lb) for males.[157][158] Like many other conditions, body weight and body type are influenced by both genetic susceptibility and environment and varies greatly among individuals.[159][160]

Humans have a far faster and more accurate throw than other animals.[161] Humans are also among the best long-distance runners in the animal kingdom, but slower over short distances.[162][150] Humans' thinner body hair and more productive sweat glands help avoid heat exhaustion while running for long distances.[163]

Genetics

A graphical representation of the standard human karyotype, including both the female (XX) and male (XY) sex chromosomes (bottom right), as well as the mitochondrial genome (shown to scale as "MT" at bottom left).

Like most animals, humans are a diploid and eukaryotic species. Each somatic cell has two sets of 23 chromosomes, each set received from one parent; gametes have only one set of chromosomes, which is a mixture of the two parental sets. Among the 23 pairs of chromosomes, there are 22 pairs of autosomes and one pair of sex chromosomes. Like other mammals, humans have an XY sex-determination system, so that females have the sex chromosomes XX and males have XY.[164] Genes and environment influence human biological variation in visible characteristics, physiology, disease susceptibility and mental abilities. The exact influence of genes and environment on certain traits is not well understood.[165][166]

While no humans – not even monozygotic twins – are genetically identical,[167] two humans on average will have a genetic similarity of 99.5%-99.9%.[168][169] This makes them more homogeneous than other great apes, including chimpanzees.[170][171] This small variation in human DNA compared to many other species suggests a population bottleneck during the Late Pleistocene (around 100,000 years ago), in which the human population was reduced to a small number of breeding pairs.[172][173] The forces of natural selection have continued to operate on human populations, with evidence that certain regions of the genome display directional selection in the past 15,000 years.[174]

The human genome was first sequenced in 2001[175] and by 2020 hundreds of thousands of genomes had been sequenced.[176] In 2012 the International HapMap Project had compared the genomes of 1,184 individuals from 11 populations and identified 1.6 million single nucleotide polymorphisms.[177] African populations harbor the highest number of private genetic variants. While many of the common variants found in populations outside of Africa are also found on the African continent, there are still large numbers that are private to these regions, especially Oceania and the Americas.[178] By 2010 estimates, humans have approximately 22,000 genes.[179] By comparing mitochondrial DNA, which is inherited only from the mother, geneticists have concluded that the last female common ancestor whose genetic marker is found in all modern humans, the so-called mitochondrial Eve, must have lived around 90,000 to 200,000 years ago.[180][181][182][183]

Yorum

Göçler nedeniyle tüm Evrene yayılan insan, Homo sapiens, sapiens, kendi içinde evolüsyon ve birçok genetik değişime uğraması doğal karşılanmalıdır. Sarı saç, mavi göz belirgin olanıdır. Genetik olarak bakıldığında, son zamanlarda olan Covid-19 yapısında ispatlandığı gibi, insan genomunu tutmakta, mitokondriyal RNA/DNA ile tek bize özgü hastalık oluşmaktadır.

Özet olarak anne yumurtası genetik işareti ile mitokondriyal Havva, tek tür, tek insandan oluşan bir tür olduğu kesinlik kazanmıştır. Bunun 90-200-300bin yıl önceye dayanması ile ilk insanın oluşumunu tanımlamaktadır.

Life cycle

Most human reproduction takes place by internal fertilization via sexual intercourse, but can also occur through assisted reproductive technology procedures.[184] The average gestation period is 38 weeks, but a normal pregnancy can vary by up to 37 days.[185] Embryonic development in the human covers the first eight weeks of development; at the beginning of the ninth week the embryo is termed a fetus.[186] Humans are able to induce early labor or perform a caesarean section if the child needs to be born earlier for medical reasons.[187] In developed

countries, infants are typically 3–4 kg (7–9 lb) in weight and 47–53 cm (19–21 in) in height at birth.[188][189] However, low birth weight is common in developing countries, and contributes to the high levels of infant mortality in these regions.[190]

Compared with other species, human childbirth is dangerous, with a much higher risk of complications and death.[191] The size of the fetus's head is more closely matched to the pelvis than other primates.[192] The reason for this is not completely understood,[n 3] but it contributes to a painful labor that can last 24 hours or more.[194] The chances of a successful labor increased significantly during the 20th century in wealthier countries with the advent of new medical technologies. In contrast, pregnancy and natural childbirth remain hazardous ordeals in developing regions of the world, with maternal death rates approximately 100 times greater than in developed countries.[195]

Both the mother and the father provide care for human offspring, in contrast to other primates, where parental care is mostly done by the mother.[196] Helpless at birth, humans continue to grow for some years, typically reaching sexual maturity at 15 to 17 years of age.[197][198][199] The human life span has been split into various stages ranging from three to twelve. Common stages include infancy, childhood, adolescence, adulthood and old age.[200] The lengths of these stages have varied across cultures and time periods but is typified by an unusually rapid growth spurt during adolescence.[201] Human females undergo menopause and become infertile at around the age of 50.[202] It has been proposed that menopause increases a woman's overall reproductive success by allowing her to invest more time and resources in her existing offspring, and in turn their children (the grandmother hypothesis), rather than by continuing to bear children into old age.[203][204]

The life span of an individual depends on two major factors, genetics and lifestyle choices.[205] For various reasons, including biological/genetic causes, women live on average about four years longer than men.[206] As of 2018, the global average life expectancy at birth of a girl is estimated to be 74.9 years compared to 70.4 for a boy.[207][208] There are significant geographical variations in human life expectancy, mostly correlated with economic development – for example, life expectancy at birth in Hong Kong is 87.6 years for girls and 81.8 for boys, while in the Central African Republic, it is 55.0 years for girls and 50.6 for boys.[209][210] The developed world is generally aging, with the median age around 40 years. In the developing world, the median age is between 15 and 20 years. While one in five Europeans is 60 years of age or older, only one in twenty Africans is 60 years of age or older.[211] In 2012, the United Nations estimated that there were 316,600 living centenarians (humans of age 100 or older) worldwide.[212]

Diet

Humans are omnivorous, capable of consuming a wide variety of plant and animal material.[213][214] Human groups have adopted a range of diets from purely vegan to primarily carnivorous. In some cases, dietary restrictions in humans can lead to deficiency diseases; however, stable human groups have adapted to many dietary patterns through both genetic specialization and cultural conventions to use nutritionally balanced food sources.[215] The human diet is prominently reflected in human culture and has led to the development of food science.[216]

Until the development of agriculture approximately 10,000 years ago, *Homo sapiens* employed a hunter-gatherer method as their sole means of food collection.[216] This involved combining stationary food sources (such as fruits, grains, tubers, and mushrooms, insect larvae and aquatic mollusks) with wild game, which must be hunted and captured in order to be consumed.[217] It has been proposed that humans have used fire to prepare and cook food since the time of *Homo erectus*.[218] Around ten thousand years ago, humans developed agriculture,[219][220][221] which substantially altered their diet. This change in diet may also have altered human biology; with the spread of dairy farming providing a new and rich source of food, leading to the evolution of the ability to digest lactose in some adults.[222][223] The types of food consumed, and how they are prepared, have varied widely by time, location, and culture.[224][225]

In general, humans can survive for up to eight weeks without food, depending on stored body fat.[226] Survival without water is usually limited to three or four days, with a maximum of one week.[227] In 2020 it is estimated 9 million humans die every year from causes directly or indirectly related to starvation.[228][229] Childhood malnutrition is also common and contributes to the global burden of disease.[230] However, global food distribution is not even, and obesity among some human populations has increased rapidly, leading to health complications and increased mortality in some developed and a few developing countries. Worldwide, over one billion people are obese,[231] while in the United States 35% of people are obese, leading to this being described as an "obesity epidemic."[232] Obesity is caused by consuming more calories than are expended, so excessive weight gain is usually caused by an energy-dense diet.[231]

Yorum

İnsanların bedensel yapıları sorunlu olsa bile, tıbbi yaklaşımlar, izlemler ile bunun önü alınmıştır. Ataları ile aynı sorunlar oluşmuş, zamanla daha yayılımlarda gözlenmiştir.
Genel sağlık politikası ötesinde, iki çocuk mevcut sayıyı korurken, üç çocuk çoğalma anlamını taşır. Çin nüfus çok diyerek bir çocuk öngörmüş, artık nüfus daha fazla azalmaması için bu sınırlamayı kaldırmıştır.
İnsanın tüm canlılarda olduğu gibi sağlıklı olması beslenmeye bağlıdır, sadece etçil değil, bitki ağırlıklı olması da bir öngörü olmuştur.

Biological variation

Changes in the number and order of genes (A–D) create genetic diversity within and between population.

There is biological variation in the human species – with traits such as blood type, genetic diseases, cranial features, facial features, organ systems, eye color, hair color and texture, height and build, and skin color varying across the globe. The typical height of an adult human is between 1.4 and 1.9 m (4 ft 7 in and 6 ft 3 in), although this varies significantly depending on sex, ethnic origin, and family bloodlines.[233][234] Body size is partly determined by genes and is also significantly influenced by environmental factors such as diet, exercise, and sleep patterns.[235]

There is evidence that populations have adapted genetically to various external factors. The genes that allow adult humans to digest lactose are present in high frequencies in populations that have long histories of cattle domestication and are more dependent on cow milk.[236] Sickle cell anemia, which may provide increased resistance to malaria, is frequent in populations where malaria is endemic.[237][238] Populations that have for a very long time inhabited specific climates tend to have developed specific phenotypes that are beneficial for those environments – short stature and stocky build in cold regions, tall and lanky in hot regions, and with high lung capacities or other adaptations at high altitudes.[239] Some populations have evolved highly unique adaptations to very specific environmental conditions, such as those advantageous to ocean-dwelling lifestyles and freediving in the Bajau.[240]

Human hair ranges in color from red to blond to brown to black, which is the most frequent.[241] Hair color depends on the amount of melanin, with concentrations fading with increased age, leading to grey or even white hair. Skin color can range from darkest brown to lightest peach, or even nearly white or colorless in cases of albinism.[242] It tends to vary clinally and generally correlates with the level of ultraviolet radiation in a particular geographic area, with darker skin mostly around the equator.[243] Skin darkening may have evolved as protection against ultraviolet solar radiation.[244] Light skin pigmentation protects against depletion of vitamin D, which requires sunlight to make.[245] Human skin also has a capacity to darken (tan) in response to exposure to ultraviolet radiation.[246][247]

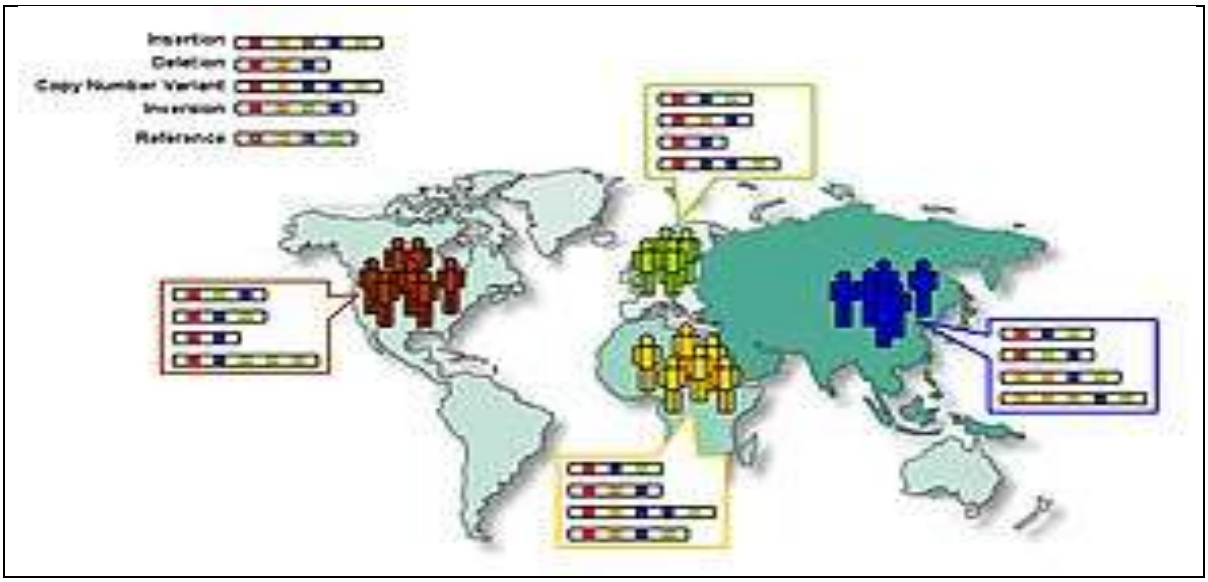
There is relatively little variation between human geographical populations, and most of the variation that occurs is at the individual level.[242][248][249] Much of human variation is continuous, often with no clear points of demarcation.[250][251][252][253] Genetic data shows that no matter how population groups are defined, two people from the same population group are almost as different from each other as two people from any two different population groups.[254][255][256] Dark-skinned populations that are found in Africa, Australia, and South Asia are not closely related to each other.[257][258]

Genetic research has demonstrated that human populations native to the African continent are the most genetically diverse[259] and genetic diversity decreases with migratory distance from Africa, possibly the result of bottlenecks during human migration.[260][261] These non-African populations acquired new genetic inputs from local admixture with archaic populations and have much greater variation from Neanderthals and Denisovans than is found in Africa,[178] though Neanderthal admixture into African populations may be underestimated.[262] Furthermore, recent studies have found that populations in sub-Saharan Africa, and particularly West Africa, have ancestral genetic variation which predates modern humans and has been lost in most non-African populations. Some of this ancestry is thought to originate from admixture with an unknown archaic hominin that diverged before the split of Neanderthals and modern humans.[263][264]

Humans are a gonochoric species, meaning they are divided into male and female sexes.[265][266][267] The greatest degree of genetic variation exists between males and females. While the nucleotide genetic variation of individuals of the same sex across global populations is no greater than 0.1%–0.5%, the genetic difference between males and females is between 1% and 2%. Males on average are 15% heavier and 15 cm (6 in) taller

than females.[268][269] On average, men have about 40–50% more upper body strength and 20–30% more lower body strength than women at the same weight, due to higher amounts of muscle and larger muscle fibers.[270] Women generally have a higher body fat percentage than men.[271] Women have lighter skin than men of the same population; this has been explained by a higher need for vitamin D in females during pregnancy and lactation.[272] As there are chromosomal differences between females and males, some X and Y chromosome-related conditions and disorders only affect either men or women.[273] After allowing for body weight and volume, the male voice is usually an octave deeper than the female voice.[274] Women have a longer life span in almost every population around the world.[275] There are intersex conditions in the human population, however these are rare.[276]

Yıllar içinde insanlar bulundukları yerde, genetik özellikler oluştururlar



Şekil 11: Bir topluluk, kendi aralarında üreme, çoğalma ile farklı bir genetik kümelenme oluşturacaklardır. A, B, C ve D grubu olarak bakıldığında, kıtalar arasında değişim belirgindir. Sarışın, kumral ve siyah saç en belirgin özellikler arasındadır.

Psychology

The human brain, the focal point of the central nervous system in humans, controls the peripheral nervous system. In addition to controlling "lower," involuntary, or primarily autonomic activities such as respiration and digestion, it is also the locus of "higher" order functioning such as thought, reasoning, and abstraction.[277] These cognitive processes constitute the mind, and, along with their behavioral consequences, are studied in the field of psychology.

Humans have a larger and more developed prefrontal cortex than other primates, the region of the brain associated with higher cognition.[278] This has led humans to proclaim themselves to be more intelligent than any other known species.[279] Objectively defining intelligence is difficult, with other animals adapting senses and excelling in areas that humans are unable to.[280]

There are some traits that, although not strictly unique, do set humans apart from other animals.[281] Humans may be the only animals who have episodic memory and who can engage in "mental time travel".[282] Even compared with other social animals, humans have an unusually high degree of flexibility in their facial expressions.[283] Humans are the only animals known to cry emotional tears.[284] Humans are one of the few animals able to self-recognize in mirror tests[285] and there is also debate over to what extent humans are the only animals with a theory of mind.[286]

Sleep and dreaming

Humans are generally diurnal. The average sleep requirement is between seven and nine hours per day for an adult and nine to ten hours per day for a child; elderly people usually sleep for six to seven hours. Having less sleep than this is common among humans, even though sleep deprivation can have negative health effects. A

sustained restriction of adult sleep to four hours per day has been shown to correlate with changes in physiology and mental state, including reduced memory, fatigue, aggression, and bodily discomfort.[287]

During sleep humans dream, where they experience sensory images and sounds. Dreaming is stimulated by the pons and mostly occurs during the REM phase of sleep.[288] The length of a dream can vary, from a few seconds up to 30 minutes.[289] Humans have three to five dreams per night, and some may have up to seven.[290] Dreamers are more likely to remember the dream if awakened during the REM phase. The events in dreams are generally outside the control of the dreamer, with the exception of lucid dreaming, where the dreamer is self-aware.[291] Dreams can at times make a creative thought occur or give a sense of inspiration.[292]

Consciousness and thought

Human consciousness, at its simplest, is sentience or awareness of internal or external existence.[293] Despite centuries of analyses, definitions, explanations and debates by philosophers and scientists, consciousness remains puzzling and controversial,[294] being "at once the most familiar and most mysterious aspect of our lives".[295] The only widely agreed notion about the topic is the intuition that it exists.[296] Opinions differ about what exactly needs to be studied and explained as consciousness. Some philosophers divide consciousness into phenomenal consciousness, which is sensory experience itself, and access consciousness, which can be used for reasoning or directly controlling actions.[297] It is sometimes synonymous with 'the mind', and at other times, an aspect of it. Historically it is associated with introspection, private thought, imagination and volition.[298] It now often includes some kind of experience, cognition, feeling or perception. It may be 'awareness', or 'awareness of awareness', or self-awareness.[299] There might be different levels or orders of consciousness,[300] or different kinds of consciousness, or just one kind with different features.[301]

The process of acquiring knowledge and understanding through thought, experience, and the senses is known as cognition.[302] The human brain perceives the external world through the senses, and each individual human is influenced greatly by his or her experiences, leading to subjective views of existence and the passage of time.[303] The nature of thought is central to psychology and related fields. Cognitive psychology studies cognition, the mental processes underlying behavior.[304] Largely focusing on the development of the human mind through the life span, developmental psychology seeks to understand how people come to perceive, understand, and act within the world and how these processes change as they age.[305][306] This may focus on intellectual, cognitive, neural, social, or moral development. Psychologists have developed intelligence tests and the concept of intelligence quotient in order to assess the relative intelligence of human beings and study its distribution among population.[307]

Motivation and emotion

Human motivation is not yet wholly understood. From a psychological perspective, Maslow's hierarchy of needs is a well-established theory that can be defined as the process of satisfying certain needs in ascending order of complexity.[308] From a more general, philosophical perspective, human motivation can be defined as a commitment to, or withdrawal from, various goals requiring the application of human ability. Furthermore, incentive and preference are both factors, as are any perceived links between incentives and preferences. Volition may also be involved, in which case willpower is also a factor. Ideally, both motivation and volition ensure the selection, striving for, and realization of goals in an optimal manner, a function beginning in childhood and continuing throughout a lifetime in a process known as socialization.[309]

Emotions are biological states associated with the nervous system[310][311] brought on by neurophysiological changes variously associated with thoughts, feelings, behavioral responses, and a degree of pleasure or displeasure.[312][313] They are often intertwined with mood, temperament, personality, disposition, creativity,[314] and motivation. Emotion has a significant influence on human behavior and their ability to learn.[315] Acting on extreme or uncontrolled emotions can lead to social disorder and crime,[316] with studies showing criminals may have a lower emotional intelligence than normal.[317]

Emotional experiences perceived as pleasant, such as joy, interest or contentment, contrast with those perceived as unpleasant, like anxiety, sadness, anger, and despair.[318] Happiness, or the state of being happy, is a human emotional condition. The definition of happiness is a common philosophical topic. Some define it as experiencing the feeling of positive emotional affects, while avoiding the negative ones.[319][320] Others see it as an appraisal of life satisfaction or quality of life.[321] Recent research suggests that being happy might involve experiencing some negative emotions when humans feel they are warranted.[322]

Sexuality and love

For humans, sexuality involves biological, erotic, physical, emotional, social, or spiritual feelings and behaviors.[323][324] Because it is a broad term, which has varied with historical contexts over time, it lacks a precise

definition.[324] The biological and physical aspects of sexuality largely concern the human reproductive functions, including the human sexual response cycle.[323][324] Sexuality also affects and is affected by cultural, political, legal, philosophical, moral, ethical, and religious aspects of life.[323][324] Sexual desire, or *libido*, is a basic mental state present at the beginning of sexual behavior. Studies show that men desire sex more than women and masturbate more often.[325]

Humans can fall anywhere along a continuous scale of sexual orientation,[326] although most humans are heterosexual.[327][328] While homosexual behavior occurs in some other animals, only humans and domestic sheep have so far been found to exhibit exclusive preference for same-sex relationships.[327] Most evidence supports nonsocial, biological causes of sexual orientation,[327] as cultures that are very tolerant of homosexuality do not have significantly higher rates of it.[328][329] Research in neuroscience and genetics suggests that other aspects of human sexuality are biologically influenced as well.[330]

Love most commonly refers to a feeling of strong attraction or emotional attachment. It can be impersonal (the love of an object, ideal, or strong political or spiritual connection) or interpersonal (love between humans).[331] When in love dopamine, norepinephrine, serotonin and other chemicals stimulate the brain's pleasure center, leading to side effects such as increased heart rate, loss of appetite and sleep, and an intense feeling of excitement.[332]

Culture

Humanity's unprecedented set of intellectual skills were a key factor in the species' eventual technological advancement and concomitant domination of the biosphere.[336] Disregarding extinct hominids, humans are the only animals known to teach generalizable information,[337] innately deploy recursive embedding to generate and communicate complex concepts,[338] engage in the "folk physics" required for competent tool design,[339][340] or cook food in the wild.[341] Teaching and learning preserves the cultural and ethnographic identity of human societies.[342] Other traits and behaviors that are mostly unique to humans include starting fires,[343] phoneme structuring[344] and vocal learning.[345]

Language

While many species communicate, language is unique to humans, a defining feature of humanity, and a cultural universal.[346] Unlike the limited systems of other animals, human language is open – an infinite number of meanings can be produced by combining a limited number of symbols.[347][348] Human language also has the capacity of displacement, using words to represent things and happenings that are not presently or locally occurring but reside in the shared imagination of interlocutors.[148]

Language differs from other forms of communication in that it is modality independent; the same meanings can be conveyed through different media, audibly in speech, visually by sign language or writing, and through tactile media such as braille.[349] Language is central to the communication between humans, and to the sense of identity that unites nations, cultures and ethnic groups.[350] There are approximately six thousand different languages currently in use, including sign languages, and many thousands more that are extinct.[351]

The arts

Human arts can take many forms including visual, literary and performing. Visual art can range from paintings and sculptures to film, interaction design and architecture.[352] Literary arts can include prose, poetry and dramas; while the performing arts generally involve theatre, music and dance.[353][354] Humans often combine the different forms (for example, music videos).[355] Other entities that have been described as having artistic qualities include food preparation, video games and medicine.[356][357][358] As well as providing entertainment and transferring knowledge, the arts are also used for political purposes.[359]

Art is a defining characteristic of humans and there is evidence for a relationship between creativity and language.[360] The earliest evidence of art was shell engravings made by *Homo erectus* 300,000 years before modern humans evolved.[361] Art attributed to *H. sapiens* existed at least 75,000 years ago, with jewellery and drawings found in caves in South Africa.[362][363] There are various hypotheses as to why humans have adapted to the arts. These include allowing them to better problem solve issues, providing a means to control or influence other humans, encouraging cooperation and contribution within a society or increasing the chance of attracting a potential mate.[364] The use of imagination developed through art, combined with logic may have given early humans an evolutionary advantage.[360]

Evidence of humans engaging in musical activities predates cave art and so far music has been practiced by virtually all known human cultures.[365] There exists a wide variety of music genres and ethnic musics; with humans' musical abilities being related to other abilities, including complex social human behaviours.[365] It has been shown that human brains respond to music by becoming synchronized with the rhythm and beat, a process

called entrainment.[366] Dance is also a form of human expression found in all cultures[367] and may have evolved as a way to help early humans communicate.[368] Listening to music and observing dance stimulates the orbitofrontal cortex and other pleasure sensing areas of the brain.[369]

Unlike speaking, reading and writing does not come naturally to humans and must be taught.[370] Still, literature has been present before the invention of words and language, with 30,000-year-old paintings on walls inside some caves portraying a series of dramatic scenes.[371] One of the oldest surviving works of literature is the *Epic of Gilgamesh*, first engraved on ancient Babylonian tablets about 4,000 years ago.[372] Beyond simply passing down knowledge, the use and sharing of imaginative fiction through stories might have helped develop humans' capabilities for communication and increased the likelihood of securing a mate.[373] Storytelling may also be used as a way to provide the audience with moral lessons and encourage cooperation.[371]

Tools and technologies

Stone tools were used by proto-humans at least 2.5 million years ago.[375] The use and manufacture of tools has been put forward as the ability that defines humans more than anything else[376] and has historically been seen as an important evolutionary step.[377] The technology became much more sophisticated about 1.8 million years ago,[376] with the controlled use of fire beginning around 1 million years ago.[378][379] The wheel and wheeled vehicles appeared simultaneously in several regions sometime in the fourth millennium BC.[61] The development of more complex tools and technologies allowed land to be cultivated and animals to be domesticated, thus proving essential in the development of agriculture – what is known as the Neolithic Revolution.[380]

China developed paper, the printing press, gunpowder, the compass and other important inventions.[381] The continued improvements in smelting allowed forging of copper, bronze, iron and eventually steel, which is used in railways, skyscrapers and many other products.[382] This coincided with the Industrial Revolution, where the invention of automated machines brought major changes to humans' lifestyles.[383] Modern technology is observed as progressing exponentially,[384] with major innovations in the 20th century including: electricity, penicillin, semiconductors, internal combustion engines, the Internet, nitrogen fixing fertilizers, airplanes, computers, automobiles, contraceptive pills, nuclear fission, the green revolution, radio, scientific plant breeding, rockets, air conditioning, television and the assembly line.[385]

Religion and spirituality

Religion is generally defined as a belief system concerning the supernatural, sacred or divine, and practices, values, institutions and rituals associated with such belief. Some religions also have a moral code. The evolution and the history of the first religions have recently become areas of active scientific investigation.[386][387][388] While the exact time when humans first became religious remains unknown, research shows credible evidence of religious behaviour from around the Middle Paleolithic era (45–200 thousand years ago).[389] It may have evolved to play a role in helping enforce and encourage cooperation between humans.[390]

There is no accepted academic definition of what constitutes religion.[391] Religion has taken on many forms that vary by culture and individual perspective in alignment with the geographic, social, and linguistic diversity of the planet.[391] Religion can include a belief in life after death (commonly involving belief in an afterlife),[392] the origin of life,[393] the nature of the universe (religious cosmology) and its ultimate fate (eschatology), and what is moral or immoral.[394] A common source for answers to these questions are beliefs in transcendent divine beings such as deities or a singular God, although not all religions are theistic.[395][396]

Although the exact level of religiosity can be hard to measure,[397] a majority of humans profess some variety of religious or spiritual belief.[398] In 2015 the plurality were Christian followed by Muslims, Hindus and Buddhists.[399] As of 2015, about 16%, or slightly under 1.2 billion humans, were irreligious, including those with no religious beliefs or no identity with any religion.[400]

Science and philosophy

An aspect unique to humans is their ability to transmit knowledge from one generation to the next and to continually build on this information to develop tools, scientific laws and other advances to pass on further.[401] This accumulated knowledge can be tested to answer questions or make predictions about how the universe functions and has been very successful in advancing human ascendancy.[402]

Aristotle has been described as the first scientist,[403] and preceded the rise of scientific thought through the Hellenistic period.[404] Other early advances in science came from the Han Dynasty in China and during the Islamic Golden Age.[405][86] The scientific revolution, near the end of the Renaissance, led to the emergence of modern science.[406]

A chain of events and influences led to the development of the scientific method, a process of observation and experimentation that is used to differentiate science from pseudoscience.[407] An understanding of mathematics is

unique to humans, although other species of animals have some numerical cognition.[408] All of science can be divided into three major branches, the formal sciences (e.g., logic and mathematics), which are concerned with formal systems, the applied sciences (e.g., engineering, medicine), which are focused on practical applications, and the empirical sciences, which are based on empirical observation and are in turn divided into natural sciences (e.g., physics, chemistry, biology) and social sciences (e.g., psychology, economics, sociology).[409]

Philosophy is a field of study where humans seek to understand fundamental truths about themselves and the world in which they live.[410] Philosophical inquiry has been a major feature in the development of humans' intellectual history.[411] It has been described as the "no man's land" between definitive scientific knowledge and dogmatic religious teachings.[412] Philosophy relies on reason and evidence, unlike religion, but does not require the empirical observations and experiments provided by science.[413] Major fields of philosophy include metaphysics, epistemology, logic, and axiology (which includes ethics and aesthetics).[414]

Society

Society is the system of organizations and institutions arising from interaction between humans. Humans are highly social and tend to live in large complex social groups. They can be divided into different groups according to their income, wealth, power, reputation and other factors. The structure of social stratification and the degree of social mobility differs, especially between modern and traditional societies.[415][*unreliable source?*] Human groups range from the size of families to nations. The first form of human social organization is thought to have resembled hunter-gatherer band societies.[416][*better source needed*]

Gender

Human societies typically exhibit gender identities and gender roles that distinguish between masculine and feminine characteristics and prescribe the range of acceptable behaviours and attitudes for their members based on their sex.[417][418] The most common categorization is a gender binary of men and women.[419] Many societies recognise a third gender,[420] or less commonly a fourth or fifth.[421][422] In some other societies, non-binary is used as an umbrella term for a range of gender identities that are not solely male or female.[423]

Gender roles are often associated with a division of norms, practices, dress, behavior, rights, duties, privileges, status, and power, with men enjoying more rights and privileges than women in most societies, both today and in the past.[424] As a social construct,[425] gender roles are not fixed and vary historically within a society. Challenges to predominant gender norms have recurred in many societies.[426][427] Little is known about gender roles in the earliest human societies. Early modern humans probably had a range of gender roles similar to that of modern cultures from at least the Upper Paleolithic, while the Neanderthals were less sexually dimorphic and there is evidence that the behavioural difference between males and females was minimal.[428]

Kinship

All human societies organize, recognize and classify types of social relationships based on relations between parents, children and other descendants (consanguinity), and relations through marriage (affinity). There is also a third type applied to godparents or adoptive children (fictive). These culturally defined relationships are referred to as kinship. In many societies, it is one of the most important social organizing principles and plays a role in transmitting status and inheritance.[429] All societies have rules of incest taboo, according to which marriage between certain kinds of kin relations are prohibited, and some also have rules of preferential marriage with certain kin relations.[430]

Ethnicity

Human ethnic groups are a social category that identifies together as a group based on shared attributes that distinguish them from other groups. These can be a common set of traditions, ancestry, language, history, society, culture, nation, religion, or social treatment within their residing area.[431][432] Ethnicity is separate from the concept of race, which is based on physical characteristics, although both are socially constructed.[433] Assigning ethnicity to a certain population is complicated, as even within common ethnic designations there can be a diverse range of subgroups, and the makeup of these ethnic groups can change over time at both the collective and individual level.[170] Also, there is no generally accepted definition of what constitutes an ethnic group.[434] Ethnic groupings can play a powerful role in the social identity and solidarity of ethnopolitical units. This has been closely tied to the rise of the nation state as the predominant form of political organization in the 19th and 20th centuries.[435][436][437]

Government and politics

As farming populations gathered in larger and denser communities, interactions between these different groups increased. This led to the development of governance within and between the communities.[438] Humans have evolved the ability to change affiliation with various social groups relatively easily, including previously strong political alliances, if doing so is seen as providing personal advantages.[439] This cognitive flexibility allows individual humans to change their political ideologies, with those with higher flexibility less likely to support authoritarian and nationalistic stances.[440]

Governments create laws and policies that affect the citizens that they govern. There have been many forms of government throughout human history, each having various means of obtaining power and the ability to exert diverse controls on the population.[441] As of 2017, more than half of all national governments are democracies, with 13% being autocracies and 28% containing elements of both.[442] Many countries have formed international political organizations and alliances, the largest being the United Nations with 193 member states.[443]

Trade and economics

Trade, the voluntary exchange of goods and services, is seen as a characteristic that differentiates humans from other animals and has been cited as a practice that gave *Homo sapiens* a major advantage over other hominids.[444] Evidence suggests early *H. sapiens* made use of long-distance trade routes to exchange goods and ideas, leading to cultural explosions and providing additional food sources when hunting was sparse, while such trade networks did not exist for the now extinct Neanderthals.[445][446] Early trade likely involved materials for creating tools like obsidian.[447] The first truly international trade routes were around the spice trade through the Roman and medieval periods.[448]

Early human economies were more likely to be based around gift giving instead of a bartering system.[449] Early money consisted of commodities; the oldest being in the form of cattle and the most widely used being cowrie shells.[450] Money has since evolved into governmental issued coins, paper and electronic money.[450] Human study of economics is a social science that looks at how societies distribute scarce resources among different people.[451] There are massive inequalities in the division of wealth among humans; the eight richest humans are worth the same monetary value as the poorest half of all the human population.[452]

Yorum

İnsanların genel özelliklerine geniş açıdan bakarsak:

- ✓ Siyah saçlı yapıdan kumral ve sarışın boyuta geçilmiştir. Ayrıca genetik majör değişim %2,5 civarında iken minör farklılık %17 oranındadır. Minörler birikerek yapı değişebilmektedir.
- ✓ İnsanın hafızası en güçlü yaratıktır, bu birikimi, medeniyetin oluşumunda katkı sağlamaktadır. Yazı ile de bu asırlardır sürmektedir. Kültürel farklılıklar sosyal boyut olarak oluşmaktadır.
- ✓ Uyku ve rüya ile aynı zamanda fantezi, masal gibi soyut kavramlara kayması da gelecek yapılanmasında önemli yer tutmaktadır.
- ✓ Mantık ile problem çözme gibi yetenekler ile sorunlar ile baş edebilmektedir.
- ✓ Motivasyon inanış ile olmakta, bu tür ve yaratıklar içinde tek tür olarak görülmektedir.
- ✓ Cinsiyete seks olarak değil, sevgi ile bakması, ona bakım, destek ve yardım ile fedakârlık kavramlarını kazandırmaktadır. Sevgi karşı cins değil, her boyuta, hayvana da olabilmektedir.
- ✓ İnsanlar grup olarak bazı ortak öğelerle teknoloji ve ortamın da oluşturması ile kültürel yapı geliştirmişlerdir. 1) Klan, göçebe Kültürü, 2) Tarım Kültürü, 3) Endüstri Kültürü, 4) Yüksek Teknoloji Kültürü, Globalleşmek, 5) Birey Hakkı Kültürü tanımlanabilir. Ancak bir toplumda farklı gruplar farklı kültürel yapıda olmaktadır.
- ✓ Lisan eklemeli dil ile, değişim olan diller olmaktadır. Her kabile, her ülke kendi dilini farklı yorumlayarak özel, özgün olmak istemektedir. İngiliz ile Amerikalı aynı dili kullanır ama farklı yapıda ele alırlar.
- ✓ Sanat farklı olsa bile birbirini etkilemiştir. İnsancıl boyut ile aykırılık değişim olarak ortaya çıkmaktadır.

- ✓ Aletler bireye göre, kültüre göre yapılanmaktadır. Bir araba aynı olsa bile, kültüre ve kişiye göre içi, müzik, araba kokusu ve kullanım farklıdır.
- ✓ İnanış olarak her bireyin kendisine has ve özgü olması, karışılmaması gerekli iken, bunlar bir kontrol ve insanları gütmek için kullanılmaktadır. Bir çoban sizi güdecektir. Birey hakkı olanda ise inanış sorulmaz bile. Yaptığı suç davranışlar ilgilenir, kişi, benlik bizi ilgilendirmez.
- ✓ Bilim insanlığın ortak buluşu iken, burada üstün olanlar diğerlerini sömürmek istemektedirler. Eskiden çelik kılıcı olan üstün ve demir kılıcı parçalar ve savaşta galip gelirmiş.
- ✓ Cinsiyet bazı toplumlarda öne çıkmakta, olumsuz tarafları ile etkin oldukları görülmektedir. Toplumun yarısı ise, etkin ekonomik boyut, ikiye katlanmasına neden olur.
- ✓ Akrabalık ve ırk gibi sosyal yapılan bölünmeler ile benim olan ile öteki farklı yapılıp, bir menfaat kazancı sağlanır. Burada genetik değil, sosyal sonradan toplumda oluşturulandır.
- ✓ Politika bir sonuca varmak için önerilerdir, seçim serbest toplumun tercihidir. Seçilemeyen ise ters ve darbe ile iktidarı ele geçirmek isterse, o zaman ortada sorunlar olacak, çünkü bir zümre ayrıcalık kazanacaktır.
- ✓ Ticaret ve ekonomi: 1) Devlet, 2) Özel ve 3) Vakıf, üçüncü sektör olarak ele alınmalıdır. Ortak kazanç ve ortak paylaşım olmayınca, diğer modellerde politik ve sosyal sorunlar kaçınılmaz olmaktadır.

İnsan kontrol edilmesi değil, kendi kontrolünü kazanması, eğitilmesi, rıza oluşturması ile sorumluluk kazandırması sağlanmalıdır. Bu şekilde olursa göçer, yeni yerleşimler kurar ama Homo erectus ve Neandertal gibi sonu tükenmez.

Conflict

Humans commit violence on other humans at a rate comparable to other primates, but have an increased preference for killing adults, infanticide being more common among other primates.[453] It is predicted that 2% of early *H. sapiens* would be murdered, rising to 12% during the medieval period, before dropping to below 2% in modern times.[454] There is great variation in violence between human populations with rates of homicide in societies that have legal systems and strong cultural attitudes against violence at about 0.01%.[455]

The willingness of humans to kill other members of their species en masse through organized conflict (i.e., war) has long been the subject of debate. One school of thought holds that war evolved as a means to eliminate competitors, and has always been an innate human characteristic. Another suggests that war is a relatively recent phenomenon and has appeared due to changing social conditions.[456] While not settled, current evidence indicates warlike predispositions only became common about 10,000 years ago, and in many places much more recently than that.[456] War has had a high cost on human life; it is estimated that during the 20th century, between 167 million and 188 million people died as a result of war.[457]

https://www.britannica.com/topic/Homo-sapiens-sapiens[7]

John P. Rafferty. Homo sapiens, sapiens, hominid subspecies

Homo sapiens, sapiens, in anthropology and paleontology, the subspecies of *Homo sapiens* that consists of the only living members of genus *Homo*, modern human beings. Traditionally, this subspecies designation was used by paleontologists and anthropologists to separate modern human beings from more-archaic members of *Homo sapiens*. *H. s. sapiens* is thought to have evolved sometime between 160,000 and 90,000 years ago in Africa before migrating first to the Middle East and Europe and later to Asia, Australia, and the Americas.

Currently, *H. s. sapiens* is the only widely accepted subspecies of *H. sapiens*, and the necessity of this designation remains a matter of debate, since traditional taxonomic practice subdivides a species only when there is evidence of two or more distinct subgroups. Several subspecies of *H. sapiens* have been proposed. For example, Swedish naturalist and explorer Carl Linnaeus, in the 10th edition of his *Systema Naturae* (1758), classified modern human beings into four subspecies according to geographic origin: *H. s. asiaticus*, *H. s. europaeus*, *H. s. afer*, and *H. s.*

americanus. Linnaeus's classification was later discarded because of the recognition of racial prejudice and outdated notions of European superiority implicit in his taxonomy and because of discoveries that only superficial differences existed between these groups.
Other groups have been classified as subspecies of *H. sapiens*—including Neanderthals (*H. s. neanderthalensis*, which most researchers later reclassified as the species *H. neanderthalensis*) and a group of specimens that were later placed in the species *H. heidelbergensis*. By the early 21st century only one group, *H. s. idàltu* (known primarily from fossil skulls discovered in 1997 near Herto, Ethiopia, and dating to about 160,000 years ago), was being considered as a second subspecies of *H. sapiens*. Some researchers have argued, however, that the Herto fossils are not distinct enough to justify the creation of a new subspecies.

Yeryüzündeki tarihi kalıntıların izleri sürülerek, kültürel odaklar gözlenmiş

Şekil 12: İnsanların Kökeni, Homo erectus 'ta kırmızı olarak verilmektedir. (İnsanın Kökeni, TUBİTAK, Hasta Hekim İlişkileri, 2005

İpek ve Baharat Yolu

Şekil 13: Karadan olan yol, İpek Yolu, denizden olana da Baharat Yolu denilmektedir

Yorum

İnsanlar ticaret yaparken, sadece mal alıp vermek değil, yolculukta eğitim olduğu, kervanlar her gece bir kurs niteliğinde ders gördüğü, gemilerde de konuşmalar yapıldığı anlaşılmaktadır. Bu yapılmaz ise, sohbet olmaz ise, iletişim ve ilişkiler bozulabilir, kavga ve çatışmaya dönebilir.
İnsanların en büyük özelliği savaş ile kazanmaktır. 622 Medine antlaşması ile bunun karşılıklı haklara saygı ile kazan/kazan olabileceği gösterilmiştir. Bu sayede insanlıkta büyük devletler kurulmuştur. Savaş ile kazanılanlar lider ölünce yıkılmış, kardeşlik ile kurulanlar ise devam etmiştir.

İnsanlar aynı Türdür, insanlar Kardeştir:
Birbirinden ayrılarak ben, sen diyerek ayrımın biyolojik, genetik bir gerekçesi yoktur. İnsanların Kökenine bakınca bu daha net anlaşılacaktır. Kişi özel, özgündür, ayrıcalıklı değil.
İnsanların tek bir yerde var olup, orada kalıp, kültürlerini orada oluşturduklarına dair tek bir veri yoktur. Bir yerden diğer yere göçleri olmuştur.
İlk genetik Tür olarak Afrika'da 130-170-300 bin yıl önce saptanmıştır. Antalya kıyılarına kadar buzulların kısmen dağlara gelmesi ve Dünya buzul döneminde olması ile var oluş, yaşama yeri, o zamanlar mümbit Sahra'dan başka yerde olması beklenmezdi.
Sahara yerleşkesi, şimdi çöl ama, o zamanlar mümbit yerlerdi.
25 bin yıl önce, Dünya ısındı ve buzullar eridi. Dolayısıyla 100bin yıl Afrika'da bir kümelenme gözlenmiş oldu. Sahra'nın çölleşmesi ile göç kaçınılmaz olmuştur.
Akdeniz 360 metre su ile dolmuş, Cebelitarık açılmış, sular Akdeniz ve boğazlar ile Karadeniz'e gelmişlerdir. Bir zamanlar sahilde oturanlar suların yükselmesi ile yok olmuşlardır. Karadeniz'de 100 metre altında yerleşim yerleri izlenmektedir.
Başlıca 3 kol belirgindir.

1) **Kafkas orijinli**: Filistin Bölgesinden geçerek Kafkalardan Orta Asya'ya yayılım. Bering Boğazından da Amerika'ya geçme, Kızılderililer. Beyaz, Kafkas orijinliler denilir.
2) **Anadolu geçişi**: Türkiye, Anadolu üzerinden geçmiş grup: örneğin, Hattuşaş'ta konuşulan dil, Germen dilinin ana hatlarını taşımaktadır.
3) **Kızıl Deniz geçişi**: Afrika Güneyinden Çin ve Hindistan'a göçen, sarı ırk denilen grup.

Kızılderililer farklı ırk gibi tanımlanmış olsalar bile, Kafkas orijinli ve Orta Asya Kökenlidirler. Hatta lisanları da eklemeli dil özelliğinde Türkçe 'ye benzer.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8647792/[8]

MitomiRs: Their Roles in Mitochondria and Importance in Cancer Cell Metabolism

Andrej Rencelj, [1,2] **Nada Gvozdenovic**, [1] and **Prof. Maja Cemazar**, Ph.D.*[1,3]

Abstract
Background
MicroRNAs (miRNAs) are short non-coding RNAs that play important roles in almost all biological pathways. They regulate post-transcriptional gene expression by binding to the 3'untranslated region (3'UTR) of messenger RNAs (mRNAs). MitomiRs are miRNAs of nuclear or mitochondrial origin that are localized in mitochondria and have a crucial role in regulation of mitochondrial function and metabolism. In eukaryotes, mitochondria are the major sites of oxidative metabolism of sugars, lipids, amino acids, and other bio-macromolecules. They are also the main sites of adenosine triphosphate (ATP) production.
Conclusions
In the review, we discuss the role of mitomiRs in mitochondria and introduce currently well studied mitomiRs, their target genes and functions. We also discuss their role in cancer initiation and progression through the

regulation of mRNA expression in mitochondria. MitomiRs directly target key molecules such as transporters or enzymes in cell metabolism and regulate several oncogenic signaling pathways. They also play an important role in the Warburg effect, which is vital for cancer cells to maintain their proliferative potential. In addition, we discuss how they indirectly upregulate hexokinase 2 (HK2), an enzyme involved in glucose phosphorylation, and thus may affect energy metabolism in breast cancer cells. In tumor tissues such as breast cancer and head and neck tumors, the expression of one of the mitomiRs (miR-210) correlates with hypoxia gene signatures, suggesting a direct link between mitomiR expression and hypoxia in cancer. The miR-17/92 cluster has been shown to act as a key factor in metabolic reprogramming of tumors by regulating glycolytic and mitochondrial metabolism. This cluster is deregulated in B-cell lymphomas, B-cell chronic lymphocytic leukemia, acute myeloid leukemia, and T-cell lymphomas, and is particularly overexpressed in several other cancers. Based on the current knowledge, we can conclude that there is a large number of miRNAs present in mitochondria, termed mitomiR, and that they are important regulators of mitochondrial function. Therefore, mitomiRs are important players in the metabolism of cancer cells, which need to be further investigated in order to develop a potential new therapy for cancer.

Key words: microRNAs, mitomiR, mitochondria, cancer, cancer cell metabolism

Introduction

MicroRNAs (miRNAs) are short non-coding RNAs (ncRNAs) of ~18-25 nucleotides that are present in all eukaryotic cells and play important roles in almost all biological signaling pathways.[1, 2, 3, 4] Since the discovery of the first miRNA (lin-4) in *C. elegans*[5], approximately 2000 miRNAs have been annotated in the human genome.[6] Data from genomic studies show that most miRNAs are highly conserved, making them very interesting targets for studying various disease states.[7] They regulate post-transcriptional gene expression by binding to the 3'UTR of messenger RNAs.[8, 9, 10, 11, 12, 13, 14] A single miRNA can regulate many mRNA targets, and conversely, a single mRNA target can be regulated by many miRNAs.[15, 16, 17] Therefore, by regulating these fundamental target genes, miRNAs have been implicated in signaling pathways to modulate a large set of important biological processes such as cell proliferation[12], metastasis[18], apoptosis[19], senescence[12], differentiation[20], autophagy[21], and immune response[22]. Moreover, miRNAs have been found to be dysregulated in many pathological conditions, such as neurodegenerative diseases[23], cardiovascular diseases[24], and cancer.[25, 26, 27, 28]

More recently, miRNAs have been found to be specifically present in mitochondria. These mitochondrial miRNAs were named "mitomiR".[7, 29, 30, 31, 32] Most of them have a nuclear origin, but some mitomiRs originate from mRNA molecules derived from the mitochondrial genome. The association of mitomiRs with mitochondria is species- and cell type-specific.[7, 33] They have been found in mitochondria in various tissues and cells and are thought to have different thermodynamic properties than miRNAs.[7, 34] Mitochondria have a discrete and unique pool of mitomiRs, which has been demonstrated with various experiments.[29]

For the first time, in 2011, Barrey and co-workers demonstrated the presence of pre-miRNAs (precursor-miRNAs) in mitochondria and postulated that some pre-miRNA sequences could be processed into mature miRNAs that could immediately become active on mitochondrial transcripts or exported to the cytosol to disrupt genomic mRNA.[35] Barrey's group screened for 742 miRNAs using qRT-PCR and showed that 243 miRNAs had significant expression in mitochondrial RNA samples isolated from human myotubes by *in situ* hybridization. This study was the first to provide evidence that pre-miRNAs can be localized in mitochondria. Subsequently, a number of studies have identified "signatures" of miRNAs localized to mitochondria through various experimental approaches. Mercer *et al*.[15] examined the human mitochondrial transcriptome and demonstrated that 3 miRNAs (miR-146a, miR-103, and miR-16) have quite high expression in the intermembrane region compared to the matrix. Latronico and Condorelli[36] found 15 nuclear-encoded miRNAs in mitochondria isolated from rat liver, 20 miRNAs from mouse liver mitochondria, and 13 miRNAs from HeLa cells (isolated from human cervical cancer) by microarray. Some other groups identified novel mitomiRs from HEK293 cells (isolated from human embryonic kidneys)[37], 143B cells (isolated from human bone marrow)[38], mouse heart[39] and HeLa cells.[37, 40]

MitomiRs have been shown to be important regulators of mitochondrial function.[35, 38, 41] The regulation of mitochondria by mitomiRs influences the development of many diseases caused by mitochondrial dysfunction, which is responsible for the pathophysiology of numerous diseases, such as cardiovascular and neurodegenerative diseases, diabetes, obesity, and cancer.[42]

In the first part of this review article, we describe the biosynthesis of mitomiRs and the transport mechanisms from mitomiRs to mitochondria. The next part is dedicated to the role of these small molecules in mitochondria and the presentation of some important mitomiRs, their target genes and functions. In the last part of the review, we discuss the functions of mitomiRs in cancer cell metabolism and introduced mitomiRs in the context of cancer.

Biosynthesis of miRNA/mitomiRs

Most miRNAs/mitomiRs are produced via the canonical biosynthetic pathway, which involves transcription by RNA polymerase II (Pol II) to produce a primary transcript (pri-miRNA/mitomiR). The primary transcript is first cleaved in the nucleus by the nuclear heterodimer Drosha/DGCR8 (DiGeorge syndrome chromosomal region 8), which cleaves the pri-miRNA/mitomiR and produces a pre-miRNA/mitomiR with a hairpin structure that is much more stable than the pri-miRNA/ mitomiR due to its characteristic hairpin loop structure.[43] Exportin 5 (EXP5) and GTP-binding nuclear protein (RANGTP) then form a transport machinery to export the pre-miRNA from the nucleus to the cytoplasm. After export to the cytoplasm, the pre-miRNA/mitomiR is further cleaved by the enzyme Dicer to form a double-stranded RNA (dsRNA) duplex (Figure 1). Only a single strand of the dsRNA duplex forms the mature miRNA/mitomiR and is incorporated into the RNA-induced silencing complex (RISC), which directs the binding of Argonaute (AGO) proteins in the RISC to the 3'UTR of the target mRNA to either repress protein translation or promote mRNA degradation.[43, 44, 45] After incorporation into RISC, mature miRNA/mitomiRs are transported into mitochondria, back to nucleus by importin 8 (IPO-8) or extracellular environment (Figure 1).[46, 47]

In addition to the canonical miRNAs/mitomiRs biosynthesis pathway, there are also non-canonical, Drosha/DGCR8-independent and Dicer-independent biosynthesis pathways. Prominent classes of Drosha/DGCR8-independent miRNAs/ mitomiRs are the "mirtrons" derived from introns that, once spliced, function as pre-miRNAs and thus do not require cleavage by Drosha/DGCR8 and can be immediately exported to the cytoplasm for processing by Dicer. MiRNAs/mitomiRs can also be processed from hairpins generated directly by Pol II at specific transcription start sites. These pre-miRNAs are capped and exported via the exportin 1 (EXP1) pathway. The Dicer-independent miRNAs/mitomiRs biosynthesis pathway involves the unusually short hairpin of miR-451, which is directly cleaved by argounaute 2 (AGO2).[45]

MitomiRs transport to mitochondria

The discovery of mitomiRs raised the question of elucidating the underlying molecular mechanisms of their transport into mitochondria. Due to their size and charged nature, mitomiRs are unlikely to cross membranes under their own power. The molecular mechanisms of mitomiR transport into mitochondria may vary between species and are not well understood.[29]

Some proposals have been published on AGO2 as a potential mitomiR import protein.[7, 29, 48] Due to its RNA-binding ability and dual localization in the cytosol and mitochondria, AGO2 might be involved in the trafficking of mitomiRs.[7] Shepherd *et al*.[49] showed that the exoribonuclease polyribonucleotide nucleotidyltransferase (PNPT1/ PNPase) has a major role in the import of mitomiRs. Therefore, PNPase could be part of an alternative, AGO2-independent, uptake pathway of mitochondrial miRNA. Furthermore, a possible mechanism could involve the voltage-dependent anion-selective channel protein (VDAC).[34] Several studies have suggested that the instability of RISC in the cytoplasm promotes miRNA translocation to mitochondria, but the molecular components that facilitate this translocation process are not fully understood. Furthermore, the concept that mammalian mitochondria can import cytosolic ncRNAs may facilitate research in another exciting area, long ncRNAs. Clearly, these translocation mechanisms and the identification of pathway components for mitochondrial targeting require further studies.[7]

Roles of mitomiRs in mitochondria

Mitochondria are semi-autonomous cell organelles with their own DNA (mtDNA) encoding 22 tRNAs, 2 rRNAs, and 13 polypeptides. These polypeptides and those encoded by nuclear genes, form 4 protein complexes of the electron transport chain (ETC). Mitochondria are constantly dividing and fusing, and the balance between mitochondrial fission and fusion influences mitochondrial morphology, whose dynamics and turnover are critical for cellular homeostasis and differentiation.[50] Several proteins are involved in the regulation of mitochondrial dynamics. Deregulation of mitochondrial dynamics is not only associated with deregulation of mitochondrial function, but is also closely related to several biological processes such as proliferation, cell death, apoptosis and production of reactive oxygen species (ROS), since mitochondria are the major sites of oxidative metabolism of sugars, lipids, amino acids and ATP production.[1, 51, 52, 53]

It's also worth noting that the mitochondrial matrix has its own set of environmental variables. Because of its thioester bond, acetyl-coenzyme A (acetyl-CoA) is a very abundant metabolite in mitochondria and functions as a powerful acetylation reagent. Protein lysine acetylation and succinylation are caused by acetyl-CoA and mitochondrial matrix pH concentrations. Non-enzymatic acetylation occurs often in mitochondria.[54] The most of mitochondrial proteins have acetyl groups, which is consistent with this hypothesis. Non-enzymatic acetylation of RNA molecules, including miRNAs, is a logical possibility for mitochondrial modification. An acetyl group covalently attached to a miRNA might change its mRNA recognition behavior. If it happens at the 2 OH group

of ribose needed for the cleavage process, it could inhibit spontaneous bond cleavage and therefore increase the half-life of mRNA. Furthermore, post-transcriptional alterations can result in structural changes[55] as well as changed interactions with other RNA molecules or proteins.[56]

As stated, mitomiRs are regulators of mitochondrial function, as shown in the following examples. *In silico* analysis identified miR-378, miR-24, and miR-23b in liver mitochondria (Table 1) and these mitomiRs have been shown to regulate systemic energy homeostasis, oxidative capacity, ROS, and mitochondrial lipid metabolism.[35, 57, 58, 59, 60, 61, 62] Several reports have indicated that miRNAs such as miR-1291, miR-138, miR-150, miR-199a, and miR-532-5p can alter the expression of some important glycolytic enzymes (Table 1).[4, 63, 64, 65, 66, 67, 68, 69, 70] miR-29a, miR-29b and miR-124 (Table 1) regulate the expression of monocarboxylate transporter 1 (SLC16A1) in pancreatic beta cells.[71] miR-33a/b has been shown to regulate lipid metabolism by targeting the cholesterol transporter ATP-binding cassette transporter (ABCA1).[72] miR-143 and miR-24 have also been shown to regulate mitochondrial lipid metabolism (Table 1).[73, 74] On the other hand, miR-204 accelerates fatty acid oxidation by inhibiting acetyl-coenzyme A carboxylase (ACC).[75] Ahmad *et al.* (2011) showed that miR-200 is associated with the regulation of phosphoglucose isomerase (PGI), which is an important factor in glycolysis and glucogenesis. Overexpression of miR-338 leads to downregulation of the protein level of cytochrome c oxidase IV and reduces mitochondrial oxygen consumption and ATP production.[77, 78] Similarly, overexpression of miR-181c decreases mt-COX1 protein and causes remodeling of the complex IV (*in vitro*)[48] and a dysfunctional complex IV (*in vivo*)[79], along with increased production of ROS. It has also been reported that miR-210 modulates the function of the complex IV by targeting the nuclear-encoded mRNA, COX10.[80, 81] It has also been reported that miR-15b, miR-16, miR-195 and miR-338 (Table 1) regulate ATP production by targeting several nuclear genes that play important roles in ETC.[77, 82, 83] miR-101-3p regulates the expression of ATP synthase subunit beta (ATP5B) in ETC (Table 1).[84] In addition, miR-210-5p reduces the expression of iron-sulfur cluster assembly enzyme (ISCU) under hypoxic conditions, which affects the proteins containing iron-sulfur clusters (Fe-S).[85] It has also been reported that miR-29a-3p[86] is involved in ß-oxidation of lipids (Table 1) and that miR-19b negatively regulates mitochondrial fusion by downregulating mitofusin 1 (MFN1).[87]

Mitochondrial DNA, Wikipedia

Mitochondrial DNA (**mtDNA** or **mDNA**)[3] is the DNA located in mitochondria, cellular organelles within eukaryotic cells that convert chemical energy from food into a form that cells can use, such as adenosine triphosphate (ATP). Mitochondrial DNA is only a small portion of the DNA in a eukaryotic cell; most of the DNA can be found in the cell nucleus and, in plants and algae, also in plastids such as chloroplasts.

Human mitochondrial DNA was the first significant part of the human genome to be sequenced.[4] This sequencing revealed that the human mtDNA includes 16,569 base pairs and encodes 13 proteins.

Since animal mtDNA evolves faster than nuclear genetic markers,[5][6][7] it represents a mainstay of phylogenetics and evolutionary biology. It also permits an tracing the relationships of populations, and so has become important in anthropology and biogeography.

Origin

Nuclear and mitochondrial DNA are thought to have separate evolutionary origins, with the mtDNA derived from the circular genomes of bacteria engulfed by the ancestors of modern eukaryotic cells. This theory is called the endosymbiotic theory. In the cells of extant organisms, the vast majority of the proteins in the mitochondria (numbering approximately 1500 different types in mammals) are coded by nuclear DNA, but the genes for some, if not most, of them are thought to be of bacterial origin, having been transferred to the eukaryotic nucleus during evolution.[8]

The reasons mitochondria have retained some genes are debated. The existence in some species of mitochondrion-derived organelles lacking a genome[9] suggests that complete gene loss is possible, and transferring mitochondrial genes to the nucleus has several advantages.[10] The difficulty of targeting remotely-produced hydrophobic protein products to the mitochondrion is one hypothesis for why some genes are retained in mtDNA;[11] colocalisation for redox regulation is another, citing the desirability of localised control over mitochondrial machinery.[12] Recent analysis of a wide range of mtDNA genomes suggests that both these features may dictate mitochondrial gene retention.[8]

Genome structure and diversity

Across all organisms, there are six main mitochondrial genome types, classified by structure (i.e. circular versus linear), size, presence of introns or plasmid like structures, and whether the genetic material is a singular molecule or collection of homogeneous or heterogeneous molecules.[13]

In many unicellular organisms (e.g., the ciliate *Tetrahymena* and the green alga *Chlamydomonas reinhardtii*), and in rare cases also in multicellular organisms (e.g. in some species of Cnidaria), the mtDNA is linear DNA. Most of these linear mtDNAs possess telomerase-independent telomeres (i.e., the ends of the linear DNA) with different modes of replication, which have made them interesting objects of research because many of these unicellular organisms with linear mtDNA are known pathogens.[14]

Animals

Most (bilaterian) animals have a circular mitochondrial genome. Medusozoa and calcarea clades however have species with linear mitochondrial chromosomes.[15] With a few exceptions, animals have 37 genes in their mitochondrial DNA: 13 for proteins, 22 for tRNAs, and 2 for rRNAs.[16]

Mitochondrial genomes for animals average about 16,000 base pairs in length.[16] The anemone *Isarachnanthus nocturnus* has the largest mitochondrial genome of any animal at 80,923 bp.[17] The smallest known mitochondrial genome in animals belongs to the comb jelly *Vallicula multiformis*, which consist of 9,961 bp.[18]

In February 2020, a jellyfish-related parasite – *Henneguya salminicola* – was discovered that lacks a mitochondrial genome but retains structures deemed mitochondrion-related organelles. Moreover, nuclear DNA genes involved in aerobic respiration and in mitochondrial DNA replication and transcription were either absent or present only as pseudogenes. This is the first multicellular organism known to have this absence of aerobic respiration and lives completely free of oxygen dependency.[19][20]

Plants and fungi

There are three different mitochondrial genome types in plants and fungi. The first type is a circular genome that has introns (type 2) and may range from 19 to 1000 kbp in length. The second genome type is a circular genome (about 20–1000 kbp) that also has a plasmid-like structure (1 kb) (type 3). The final genome type found in plants and fungi is a linear genome made up of homogeneous DNA molecules (type 5).[*citation needed*]

Great variation in mtDNA gene content and size exists among fungi and plants, although there appears to be a core subset of genes present in all eukaryotes (except for the few that have no mitochondria at all).[8] In Fungi, however, there is no single gene shared among all mitogenomes.[21] Some plant species have enormous mitochondrial genomes, with *Silene conica* mtDNA containing as many as 11,300,000 base pairs.[22] Surprisingly, even those huge mtDNAs contain the same number and kinds of genes as related plants with much smaller mtDNAs.[23] The genome of the mitochondrion of the cucumber (*Cucumis sativus*) consists of three circular chromosomes (lengths 1556, 84 and 45 kilobases), which are entirely or largely autonomous with regard to their replication.[24]

Protists

Protists contain the most diverse mitochondrial genomes, with five different types found in this kingdom. Type 2, type 3 and type 5 of the plant and fungal genomes also exist in some protists, as do two unique genome types. One of these unique types is a heterogeneous collection of circular DNA molecules (type 4) while the other is a heterogeneous collection of linear molecules (type 6). Genome types 4 and 6 each range from 1–200 kbp in size.[*citation needed*]

The smallest mitochondrial genome sequenced to date is the 5,967 bp mtDNA of the parasite *Plasmodium falciparum*.[25][26]

Replication

Mitochondrial DNA is replicated by the DNA polymerase gamma complex which is composed of a 140 kDa catalytic DNA polymerase encoded by the *POLG* gene and two 55 kDa accessory subunits encoded by the *POLG2* gene.[27] The replisome machinery is formed by DNA polymerase, TWINKLE and mitochondrial SSB proteins. TWINKLE is a helicase, which unwinds short stretches of dsDNA in the 5' to 3' direction.[28] All these polypeptides are encoded in the nuclear genome.

During embryogenesis, replication of mtDNA is strictly down-regulated from the fertilized oocyte through the preimplantation embryo.[29] The resulting reduction in per-cell copy number of mtDNA plays a role in the mitochondrial bottleneck, exploiting cell-to-cell variability to ameliorate the inheritance of damaging mutations.[30] According to Justin St. John and colleagues, "At the blastocyst stage, the onset of mtDNA replication is specific to the cells of the trophectoderm.[29] In contrast, the cells of the inner cell mass restrict mtDNA replication until they receive the signals to differentiate to specific cell types."[29]

The two strands of the human mitochondrial DNA are distinguished as the heavy strand and the light strand. The heavy strand is rich in guanine and encodes 12 subunits of the oxidative phosphorylation system, two ribosomal RNAs (12S and 16S), and 14 transfer RNAs (tRNAs). The light strand encodes one subunit, and 8 tRNAs. So, altogether mtDNA encodes for two rRNAs, 22 tRNAs, and 13 protein subunits, all of which are involved in the oxidative phosphorylation process.[33][34]

Regulation of transcription

The promoters for the initiation of the transcription of the heavy and light strands are located in the main non-coding region of the mtDNA called the displacement loop, the D-loop.[33] There is evidence that the transcription of the mitochondrial rRNAs is regulated by the heavy-strand promoter 1 (HSP1), and the transcription of the polycistronic transcripts coding for the protein subunits are regulated by HSP2.[33]

Measurement of the levels of the mtDNA-encoded RNAs in bovine tissues has shown that there are major differences in the expression of the mitochondrial RNAs relative to total tissue RNA.[38] Among the 12 tissues examined the highest level of expression was observed in heart, followed by brain and steroidogenic tissue samples.[38]

As demonstrated by the effect of the trophic hormone ACTH on adrenal cortex cells, the expression of the mitochondrial genes may be strongly regulated by external factors, apparently to enhance the synthesis of mitochondrial proteins necessary for energy production.[38] Interestingly, while the expression of protein-encoding genes was stimulated by ACTH, the levels of the mitochondrial 16S rRNA showed no significant change.[38]

Mitochondrial inheritance

In most multicellular organisms, mtDNA is inherited from the mother (maternally inherited). Mechanisms for this include simple dilution (an egg contains on average 200,000 mtDNA molecules, whereas a healthy human sperm has been reported to contain on average 5 molecules),[39][40] degradation of sperm mtDNA in the male genital tract and in the fertilized egg; and, at least in a few organisms, failure of sperm mtDNA to enter the egg. Whatever the mechanism, this single parent (uniparental inheritance) pattern of mtDNA inheritance is found in most animals, most plants and also in fungi.[*citation needed*]

In a study published in 2018, human babies were reported to inherit mtDNA from both their fathers and their mothers resulting in mtDNA heteroplasmy.[41]

Female inheritance

In sexual reproduction, mitochondria are normally inherited exclusively from the mother; the mitochondria in mammalian sperm are usually destroyed by the egg cell after fertilization. Also, mitochondria are only in the sperm tail, which is used for propelling the sperm cells and sometimes the tail is lost during fertilization. In 1999 it was reported that paternal sperm mitochondria (containing mtDNA) are marked with ubiquitin to select them for later destruction inside the embryo.[42] Some *in vitro* fertilization techniques, particularly injecting a sperm into an oocyte, may interfere with this.

The fact that mitochondrial DNA is mostly maternally inherited enables genealogical researchers to trace maternal lineage far back in time. (Y-chromosomal DNA, paternally inherited, is used in an analogous way to determine the patrilineal history.) This is usually accomplished on human mitochondrial DNA by sequencing the hypervariable control regions (HVR1 or HVR2), and sometimes the complete molecule of the mitochondrial DNA, as a genealogical DNA test.[43] HVR1, for example, consists of about 440 base pairs. These 440 base pairs are compared to the same regions of other individuals (either specific people or subjects in a database) to determine maternal lineage. Most often, the comparison is made with the revised Cambridge Reference Sequence. Vilà *et al.* have published studies tracing the matrilineal descent of domestic dogs from wolves.[44] The concept of the Mitochondrial Eve is based on the same type of analysis, attempting to discover the origin of humanity by tracking the lineage back in time.

The mitochondrial bottleneck

Entities subject to uniparental inheritance and with little to no recombination may be expected to be subject to Muller's ratchet, the accumulation of deleterious mutations until functionality is lost. Animal populations of mitochondria avoid this through a developmental process known as the mtDNA bottleneck. The bottleneck exploits random processes in the cell to increase the cell-to-cell variability in mutant load as an organism develops: a single egg cell with some proportion of mutant mtDNA thus produces an embryo in which different cells have different mutant loads. Cell-level selection may then act to remove those cells with more mutant mtDNA, leading to a stabilisation or reduction in mutant load between generations. The mechanism underlying the bottleneck is debated,[45][46][47][48] with a recent mathematical and experimental metastudy providing evidence for a combination of the random partitioning of mtDNAs at cell divisions and the random turnover of mtDNA molecules within the cell.[30]

Male inheritance

Male mitochondrial DNA inheritance has been discovered in Plymouth Rock chickens.[49] Evidence supports rare instances of male mitochondrial inheritance in some mammals as well. Specifically, documented occurrences exist for mice,[50][51] where the male-inherited mitochondria were subsequently rejected. It has also been found in

sheep,[52] and in cloned cattle.[53] Rare cases of male mitochondrial inheritance have been documented in humans.[54][55][56][41] Although many of these cases involve cloned embryos or subsequent rejection of the paternal mitochondria, others document *in vivo* inheritance and persistence under lab conditions.

Doubly uniparental inheritance of mtDNA is observed in bivalve mollusks. In those species, females have only one type of mtDNA (F), whereas males have F type mtDNA in their somatic cells, but M type of mtDNA (which can be as much as 30% divergent) in germline cells.[57] Paternally inherited mitochondria have additionally been reported in some insects such as fruit flies,[58][59] honeybees,[60] and periodical cicadas.[61]

Mitochondrial donation

An IVF technique known as mitochondrial donation or mitochondrial replacement therapy (MRT) results in offspring containing mtDNA from a donor female, and nuclear DNA from the mother and father. In the spindle transfer procedure, the nucleus of an egg is inserted into the cytoplasm of an egg from a donor female which has had its nucleus removed, but still contains the donor female's mtDNA. The composite egg is then fertilized with the male's sperm. The procedure is used when a woman with genetically defective mitochondria wishes to procreate and produce offspring with healthy mitochondria.[62] The first known child to be born as a result of mitochondrial donation was a boy born to a Jordanian couple in Mexico on 6 April 2016.[63]

Mutations and disease

Susceptibility

The concept that mtDNA is particularly susceptible to reactive oxygen species generated by the respiratory chain due to its proximity remains controversial.[64] mtDNA does not accumulate any more oxidative base damage than nuclear DNA.[65] It has been reported that at least some types of oxidative DNA damage are repaired more efficiently in mitochondria than they are in the nucleus.[66] mtDNA is packaged with proteins which appear to be as protective as proteins of the nuclear chromatin.[67] Moreover, mitochondria evolved a unique mechanism which maintains mtDNA integrity through degradation of excessively damaged genomes followed by replication of intact/repaired mtDNA. This mechanism is not present in the nucleus and is enabled by multiple copies of mtDNA present in mitochondria.[68] The outcome of mutation in mtDNA may be an alteration in the coding instructions for some proteins,[69] which may have an effect on organism metabolism and/or fitness.

Genetic illness

Mutations of mitochondrial DNA can lead to a number of illnesses including exercise intolerance and Kearns–Sayre syndrome (KSS), which causes a person to lose full function of heart, eye, and muscle movements. Some evidence suggests that they might be major contributors to the aging process and age-associated pathologies.[70] Particularly in the context of disease, the proportion of mutant mtDNA molecules in a cell is termed heteroplasmy. The within-cell and between-cell distributions of heteroplasmy dictate the onset and severity of disease[71] and are influenced by complicated stochastic processes within the cell and during development.[30][72]

Mutations in mitochondrial tRNAs can be responsible for severe diseases like the MELAS and MERRF syndromes.[73]

Mutations in nuclear genes that encode proteins that mitochondria use can also contribute to mitochondrial diseases. These diseases do not follow mitochondrial inheritance patterns, but instead follow Mendelian inheritance patterns.[74]

Use in disease diagnosis

Recently a mutation in mtDNA has been used to help diagnose prostate cancer in patients with negative prostate biopsy.[75][76] mtDNA alterations can be detected in the bio-fluids of patients with cancer.[77] mtDNA is characterized by the high rate of polymorphisms and mutations. Some of which are increasingly recognized as an important cause of human pathology such as oxidative phosphorylation (OXPHOS) disorders, maternally inherited diabetes and deafness (MIDD), Type 2 diabetes mellitus, Neurodegenerative disease, heart failure and cancer.

Relationship with ageing

Though the idea is controversial, some evidence suggests a link between aging and mitochondrial genome dysfunction.[78] In essence, mutations in mtDNA upset a careful balance of reactive oxygen species (ROS) production and enzymatic ROS scavenging (by enzymes like superoxide dismutase, catalase, glutathione peroxidase and others). However, some mutations that increase ROS production (e.g., by reducing antioxidant defenses) in worms increase, rather than decrease, their longevity.[64] Also, naked mole rats, rodents about the size of mice, live about eight times longer than mice despite having reduced, compared to mice, antioxidant defenses and increased oxidative damage to biomolecules.[79] Once, there was thought to be a positive feedback loop at work (a 'Vicious Cycle'); as mitochondrial DNA accumulates genetic damage caused by free radicals, the

mitochondria lose function and leak free radicals into the cytosol. A decrease in mitochondrial function reduces overall metabolic efficiency.[80] However, this concept was conclusively disproved when it was demonstrated that mice, which were genetically altered to accumulate mtDNA mutations at accelerated rate do age prematurely, but their tissues do not produce more ROS as predicted by the 'Vicious Cycle' hypothesis.[81] Supporting a link between longevity and mitochondrial DNA, some studies have found correlations between biochemical properties of the mitochondrial DNA and the longevity of species.[82] The application of a mitochondrial-specific ROS scavenger, which lead to a significant longevity of the mice studied,[83] suggests that mitochondria may still be well-implicated in ageing. Extensive research is being conducted to further investigate this link and methods to combat ageing. Presently, gene therapy and nutraceutical supplementation are popular areas of ongoing research.[84][85] Bjelakovic et al. analyzed the results of 78 studies between 1977 and 2012, involving a total of 296,707 participants, and concluded that antioxidant supplements do not reduce all-cause mortality nor extend lifespan, while some of them, such as beta carotene, vitamin E, and higher doses of vitamin A, may actually increase mortality.[86] In a recent study, it was showed that dietary restriction can reverse ageing alterations by affecting the accumulation of mtDNA damage in several organs of rats. For example, dietary restriction prevented age-related accumulation of mtDNA damage in the cortex and decreased it in the lung and testis.[87]

Neurodegenerative diseases

Increased mtDNA damage is a feature of several neurodegenerative diseases.

The brains of individuals with Alzheimer's disease have elevated levels of oxidative DNA damage in both nuclear DNA and mtDNA, but the mtDNA has approximately 10-fold higher levels than nuclear DNA.[88] It has been proposed that aged mitochondria is the critical factor in the origin of neurodegeneration in Alzheimer's disease.[89] Analysis of the brains of AD patients suggested an impaired function of the DNA repair pathway, which would cause reduce the overall quality of mtDNA.[90]

In Huntington's disease, mutant huntingtin protein causes mitochondrial dysfunction involving inhibition of mitochondrial electron transport, higher levels of reactive oxygen species and increased oxidative stress.[91] Mutant huntingtin protein promotes oxidative damage to mtDNA, as well as nuclear DNA, that may contribute to Huntington's disease pathology.[92]

The DNA oxidation product 8-oxoguanine (8-oxoG) is a well-established marker of oxidative DNA damage. In persons with amyotrophic lateral sclerosis (ALS), the enzymes that normally repair 8-oxoG DNA damages in the mtDNA of spinal motor neurons are impaired.[93] Thus oxidative damage to mtDNA of motor neurons may be a significant factor in the etiology of ALS.

Over the past decade, an Israeli research group led by Professor Vadim Fraifeld has shown that strong and significant correlations exist between the mtDNA base composition and animal species-specific maximum life spans.[94][95][96] As demonstrated in their work, higher mtDNA guanine + cytosine content (GC%) strongly associates with longer maximum life spans across animal species. An additional observation is that the mtDNA GC% correlation with the maximum life spans is independent of the well-known correlation between animal species metabolic rate and maximum life spans. The mtDNA GC% and resting metabolic rate explain the differences in animal species maximum life spans in a multiplicative manner (i.e., species maximum life span = their mtDNA GC% * metabolic rate).[95] To support the scientific community in carrying out comparative analyses between mtDNA features and longevity across animals, a dedicated database was built named MitoAge.[97]

mtDNA mutational spectrum is sensitive to species-specific life-history traits

De novo mutations arise either due to mistakes during DNA replication or due to unrepaired damage caused in turn by endogenous and exogenous mutagens. It has been long believed that mtDNA can be particularly sensitive to damage caused by reactive oxygen species (ROS), however G>T substitutions, the hallmark of the oxidative damage in the nuclear genome, are very rare in mtDNA and do not increase with age. Comparing the mtDNA mutational spectra of hundreds of mammalian species, it has been recently demonstrated that species with extended lifespans have an increased rate of A>G substitutions on single-stranded heavy chain.[98] This discovery led to the hypothesis that A>G is a mitochondria-specific marker of age-associated oxidative damage. This finding provides a mutational (contrary to the selective one) explanation for the observation that long-lived species have GC-rich mtDNA: long-lived species become GC-rich simply because of their biased process of mutagenesis. An association between mtDNA mutational spectrum and species-specific life-history traits in mammals opens a possibility to link these factors together discovering new life-history-specific mutagens in different groups of organisms.

Relationship with non-B (non-canonical) DNA structures

Deletion breakpoints frequently occur within or near regions showing non-canonical (non-B) conformations, namely hairpins, cruciforms and cloverleaf-like elements.[99] Moreover, there is data supporting the involvement of helix-distorting intrinsically curved regions and long G-tetrads in eliciting instability events. In addition, higher breakpoint densities were consistently observed within GC-skewed regions and in the close vicinity of the degenerate sequence motif YMMYMNNMMHM.[100]

Use in forensics

Unlike nuclear DNA, which is inherited from both parents and in which genes are rearranged in the process of recombination, there is usually no change in mtDNA from parent to offspring. Although mtDNA also recombines, it does so with copies of itself within the same mitochondrion. Because of this and because the mutation rate of animal mtDNA is higher than that of nuclear DNA,[101] mtDNA is a powerful tool for tracking ancestry through females (matrilineage) and has been used in this role to track the ancestry of many species back hundreds of generations.

mtDNA testing can be used by forensic scientists in cases where nuclear DNA is severely degraded. Autosomal cells only have two copies of nuclear DNA, but can have hundreds of copies of mtDNA due to the multiple mitochondria present in each cell. This means highly degraded evidence that would not be beneficial for STR analysis could be used in mtDNA analysis. mtDNA may be present in bones, teeth, or hair, which could be the only remains left in the case of severe degradation. In contrast to STR analysis, mtDNA sequencing uses Sanger sequencing. The known sequence and questioned sequence are both compared to the Revised Cambridge Reference Sequence to generate their respective haplotypes. If the known sample sequence and questioned sequence originated from the same matriline, one would expect to see identical sequences and identical differences from the rCRS.[102] Cases arise where there are no known samples to collect and the unknown sequence can be searched in a database such as EMPOP. The Scientific Working Group on DNA Analysis Methods recommends three conclusions for describing the differences between a known mtDNA sequence and a questioned mtDNA sequence: exclusion for two or more differences between the sequences, inconclusive if there is one nucleotide difference, or cannot exclude if there are no nucleotide differences between the two sequences.[103]

The rapid mutation rate (in animals) makes mtDNA useful for assessing genetic relationships of individuals or groups within a species and also for identifying and quantifying the phylogeny (evolutionary relationships; see phylogenetics) among different species. To do this, biologists determine and then compare the mtDNA sequences from different individuals or species. Data from the comparisons is used to construct a network of relationships among the sequences, which provides an estimate of the relationships among the individuals or species from which the mtDNAs were taken. mtDNA can be used to estimate the relationship between both closely related and distantly related species. Due to the high mutation rate of mtDNA in animals, the 3rd positions of the codons change relatively rapidly, and thus provide information about the genetic distances among closely related individuals or species. On the other hand, the substitution rate of mt-proteins is very low, thus amino acid changes accumulate slowly (with corresponding slow changes at 1st and 2nd codon positions) and thus they provide information about the genetic distances of distantly related species. Statistical models that treat substitution rates among codon positions separately, can thus be used to simultaneously estimate phylogenies that contain both closely and distantly related species[73]

Mitochondrial DNA was admitted into evidence for the first time ever in a United States courtroom in 1996 during *State of Tennessee v. Paul Ware*.[104]

In the 1998 United States court case of Commonwealth of Pennsylvania v. Patricia Lynne Rorrer,[105] mitochondrial DNA was admitted into evidence in the State of Pennsylvania for the first time.[106][107] The case was featured in episode 55 of season 5 of the true crime drama series Forensic Files (season 5).[108]

Mitochondrial DNA was first admitted into evidence in California, United States, in the successful prosecution of David Westerfield for the 2002 kidnapping and murder of 7-year-old Danielle van Dam in San Diego: it was used for both human and dog identification.[109] This was the first trial in the U.S. to admit canine DNA.[110]

The remains of King Richard III, who died in 1485, were identified by comparing his mtDNA with that of two matrilineal descendants of his sister who were alive in 2013, 527 years after he died.[111]

Use in evolutionary biology and systematic biology

mtDNA is conserved across eukaryotic organism given the critical role of mitochondria in cellular respiration. However, due to less efficient DNA repair (compared to nuclear DNA) it has a relatively high mutation rate (but slow compared to other DNA regions such as microsatellites) which makes it useful for studying the evolutionary

relationships—phylogeny—of organisms. Biologists can determine and then compare mtDNA sequences among different species and use the comparisons to build an evolutionary tree for the species examined.
For instance, while most nuclear genes are nearly identical between humans and chimpanzees, their mitochondrial genomes are 9.8% different. Human and gorilla mitochondrial genomes are 11.8% different, suggesting that humans may be more closely related to chimpanzees than gorillas.[112]
mtDNA in nuclear DNA
Whole genome sequences of more than 66,000 people revealed that most of them had some mitochondrial DNA inserted into their nuclear genomes. More than 90% of these nuclear-mitochondrial segments (NUMTs) were inserted after humans diverged from apes. Results indicate such transfers currently occur as frequent as once in every ~4,000 human births.[113]
It appears that organellar DNA is much more often transferred to nuclear DNA than previously thought. This observation also supports the idea of the endosymbiont theory that eukaryotes have evolved from endosymbionts which turned into organelles while transferring most of their DNA to the nucleus so that the organellar genome shrunk in the process.[114]
History
Mitochondrial DNA was discovered in the 1960s by Margit M. K. Nass and Sylvan Nass by electron microscopy as DNase-sensitive threads inside mitochondria,[115] and by Ellen Haslbrunner, Hans Tuppy and Gottfried Schatz by biochemical assays on highly purified mitochondrial fractions.[116]
Mitochondrial sequence databases
Several specialized databases have been founded to collect mitochondrial genome sequences and other information. Although most of them focus on sequence data, some of them include phylogenetic or functional information.

- **AmtDB:** a database of ancient human mitochondrial genomes.[117]
- **InterMitoBase**: an annotated database and analysis platform of protein-protein interactions for human mitochondria.[118] (apparently last updated in 2010, but still available)
- **MitoBreak**: the mitochondrial DNA breakpoints database.[119]
- **MitoFish** and **MitoAnnotator**: a mitochondrial genome database of fish.[120] See also Cawthorn et al.[121]
- **Mitome:** a database for comparative mitochondrial genomics in metazoan animals[122] (no longer available)
- **MitoRes:** a resource of nuclear-encoded mitochondrial genes and their products in metazoa[123] (apparently no longer being updated)
- **MitoSatPlant**: Mitochondrial microsatellites database of viridiplantae.[124]
- **MitoZoa** 2.0: a database for comparative and evolutionary analyses of mitochondrial genomes in Metazoa.[125] (no longer available)

MtDNA-phenotype association databases
Genome-wide association studies can reveal associations of mtDNA genes and their mutations with phenotypes including lifespan and disease risks. In 2021, the largest, UK Biobank-based, genome-wide association study of mitochondrial DNA unveiled 260 new associations with phenotypes including lifespan and disease risks for e.g. type 2 diabetes.[126][127]
Mitochondrial mutation databases
Several specialized databases exist that report polymorphisms and mutations in the human mitochondrial DNA, together with the assessment of their pathogenicity.

- **MitImpact**: A collection of pre-computed pathogenicity predictions for all nucleotide changes that cause non-synonymous substitutions in human mitochondrial protein coding genes MitImpact 3D - IRCCS-CSS Bioinformatics lab.
- **MITOMAP**: A compendium of polymorphisms and mutations in human mitochondrial DNA WebHome < MITOMAP < Foswiki.

Yorum

Referansta detay bilgi sunulmaktadır. Bu Makalede konu fazla detaya inerse, anlamı kaçırmış olacaktır, metin verilmiş, yorum yapılmayacaktır.
Evolüsyon, değişim, başkalaşım biyolojide temel boyuttur, bunun büyüme ve gelişme üzerine olması beklenir, arzulanır, buna göre yapılanma yapılmalıdır.
Hepimiz Homo sapiens, sapiens türüyüz, aksi ispat edilmemiştir.
Akılda kalması gereken şey; ***bizler tek tür, hepimiz kardeşiz***.

Sonuç

Milyonlarca yıl Evrende olan Homo erectus ve Neandertal türleri varken, insan, Homo sapiens, sapiens 160-90bin yıldır varlığı gözlenmiştir. 300bin yıl önce ilk genetik saptanmıştır.

Bu Makalede Homo erectus ve Neandertal yapıdan, insan, Homo sapiens, sapiens kaynaklarla incelenerek, durum, yapı ortaya konulmaya çalışılmıştır.

Türlerin yapısal özellikleri ile bir süre sonra yok oldukları gözlenmektedir.
İnsanlar da acaba yok olacaklar mıdır?
Birbirlerini ayırımcılık, sınıflara ayırmak, benlik ve çatışmalar ile kazanç sağlama talebi ile birbirini yok etmek ile sonlanma olabilecektir. Zamanımızda bölgesel çatışmalar ile, toplumun 3-5 milyonunu yok etmektedirler. Ayrıca 10 milyon kişi de göçmektedir.
Göçler bir kurtuluş değil, yokluk boyutu olmakta, gittikleri yerde köle bile değil, öldürülmektedirler. Göç kurtuluş olması beklenilmektedir.
Peygamberimizin göç etmesi ile oluşan 622 Medine antlaşması ile insanlık anayasası, birey hakkı ve karşılıklı sevgi ve hizmet ile savaş değil fetih kavramı getirilmiştir. Alınan yere hizmet ve insanlık boyutu, sevgi ile getirilmektedir. Kabilelere karışılmamakta, inanışlarına dokunulmamaktadır.

Bunların olmadığı yerde, savaşa, kan, ateş ve yok edilmesi olmaktadır. Sonuçta amaç zarar ve zalimi, kötülüğü yok etmek iken, insanlığı yok etmenin anlamı olamaz. Enteresan boyut, bunlar insanlık, demokrasi ve barış götürmek için yapılmaktadır.

Sonuçta, İnsanların sonunu kendileri getirecek, ama gerekçe barış, sevgi ve insanlık ile karşılıklı kardeşlikte anlaşarak kurtarmak olacaktır.

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