Evolution of the species Homo sapiens

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Phylogeny

The first primate lineages diverged more than 70 million years ago, but the hominoid lineage did not diverge from the Old World monkeys until approximately 30–40 million years ago.

> The superfamily *Hominoidea* includes small apes (gibbons) and great apes, including humans. We refer to great apes and man as ***hominids*'', man and his closest relatives as** *hominins*.

Evolutionary trends observable in hominins are:

- bipedal locomotion,
- expansion of the size of the brain and its rounding,
- reduction of sexual dimorphism,
- gracilization of teeth,
- gracilization of the musculature,
- presence of chromosome 2 (fusion of 2 ancestral acrocentric chromosomes),
- the presence of a second PAR2 pseudoautosomal region at the ends of the long arms of human gonosomes (reproductive barrier).

Paleogenomics and molecular methods of hominoid phylogeny

In the 1960s, hominoid phylogeny began to be mapped using serum albumin. A few years later, using DNA-DNA hybridization, it was found that the closest human relative is the chimpanzee, which has only 1-2% sequence differences (expressed in mutations would make approx. 30–60 million deletions or insertions).[1]

Today, analyzes are focused more on archaic DNA, which must be worked with in a completely sterile manner, as it is extremely prone to contamination.

Paleogenomic analyzes have shown that relatively large migrations took place in the past, which could have led to the interbreeding of various species of the genus Homo. For example, it is estimated that somewhere around 2-20% of Neanderthal sequences are found in the current population, most commonly around 2.5%. These have affected skin characteristics, adaptation to changing conditions, susceptibility to Crohn's disease, susceptibility to type 2 diabetes, even susceptibility to smoking.

Genome evolution

The course of the development of the genus Homo can also be documented by the emergence of genes typical for hominids. These include the genes "FOXP2", "CA8" and "HERC2", which have an effect on specifically human characteristics, such as speech, upright walking, and hair and eye pigmentation. These genes are described in more detail in *Homo neanderthalensis*.

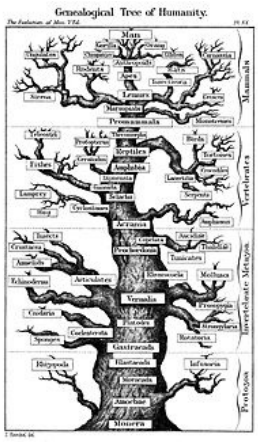
Evolution of the family *Hominidae*

The known developmental stages of the Hominidae family are the genera Ramapithecus, Australopithecus and Homo. **However, it is important to realize that the development did not go step by step! In many cases it went together and species could meet and even interbreed!**

Ramapithecus

- Widespread in Africa, Europe and Asia at the transition of the Miocene and Pliocene.
- When standing upright, 100-110 cm tall, they moved mostly quadrapedally (on all fours, with the ankles of the fingers bent into a fist).
- A flat brain house with a volume of about 350 cm³.
- Collected seeds and other plant food in groups.

Australopithecus



- Widespread in Africa at the transition of the Pliocene and Pleistocene, there were several species, but the mutual phylogeny is unclear, the adaptive radiation of Australopithecus species occurred 3 million years ago in Africa.
- They were 115–125 cm tall, weighed about 25–35 kg, were able to walk upright, walked bipedally.
- Their heads had a more vaulted braincase with a volume of about 490 cm³ and the cerebral cortex was richly grooved.
- They were omnivores with a predominantly meaty diet.

genus *Homo*

It probably originated about 2 million years ago in Africa. From the point of view of species identification, in the case of fossils, biological definition of species, assuming the possibility of successful crossing to produce viable and fertile hybrids only within the given species, is not applicable. However, the possibility of comparing the genomes of fossil representatives brings interesting insights in this direction.

Homo erectus

- Character adapted to walking, based on this the proportions for leaving Africa and migrating to other corners of the world (Indonesia, China).

- They knew how to make tools, they communicated.
- They had a flat face, a spherical braincase, a supraorbital mound, there is a typical postorbital narrowing on the skulls (can be seen on this image (http://s.hswstatic.com/gif/evolution-skull.jpg)), the braincase capacity was about 1100 cm^3.
- He lived and hunted in steppe landscapes with sparse forests, lived in caves, made pointed fist wedges, axes and scrapers from stones, knew fire.

Homo habilis

- Lived in central and eastern Africa already in the early Pleistocene.
- In the somatic series in terms of features, he was more advanced than Australopithecus (average cranial capacity of about 750 cm^3, had typical human denition and upright stature).
- The foot arch also corresponded to bipedal walking, the toes ended with nails.

Homo floresiensis

- Skeletal remains and other smaller finds in Indonesia point to the possibility of a separate species with a relatively small braincase.
- He was small in stature (height 1 m, weight 25 kg, a "hobbit" from Flores, where he lived 18 thousand years ago).
- However, there is much controversy surrounding its recognition[2].

Homo neanderthalensis

- A robust, cold weather-adapted species of man, evolutionarily follows the findings of European Homo heidelbergensis fossils.
- Documented in the fossil record between 220 and 35 thousand years ago, so he was a contemporary of H. sapiens, with whom he interbred.
- Skull with supraorbital arches, brain chamber capacity 1400-1450 cm^3, lived and hunted in groups, knew and carefully maintained fire, made stone tools from flint chips, processed bone and wooden tools quite complexly. He created a primitive communal society, vocal expressions gradually evolved into simple speech - the same variant of the FOXP2 gene was found in the genetically examined fossils as in today's humans.
  - FOXP2 is a gene that affects the ability to learn language, it is located on chromosome 7. If this gene is mutated, patients are unable to speak articulately, the relevant nerve centers are underdeveloped. The same variant of this gene was found in Neanderthals and Denisovans as in modern humans.
- He probably had a system of cults and rituals, burying his dead in the center of the caves. The first personal ornaments are documented.
- **HERC2 Gene**
  - Molecular genetic research on the fossils of Homo neanderthalensis led to the discovery of gene variants that are jointly responsible for blue eyes, light skin and redness in today's humans. The same SNP (single nucleotide polymorphisms) in the HERC2 gene was found in the examined fossils, which conditions blue-eye in humans today. The product of the HERC 2 gene itself is not involved in pigmentation, however, a SNP in its sequence affects the transcription of the OCA2 gene (mutations in this gene cause oculocutaneous albinism type 2), its function is essential for the character of iris pigmentation.

Homo denisoviensis

- A type of man named Denisovan after the place where the fossils were found (Děnisova jeskyně in Altai).
- Described only based on molecular genome analysis from fossils (phalange and molar).
- In the fossil record between 48 and 30 thousand years ago, he was a contemporary of both Neanderthals and modern humans.
- Research shows that they contributed 4-6% of their genome to the gene pool of today's Melanesians.[3] So this is one of the **evidences of the crossing of different developmental branches of the genus *Homo***.

Homo sapiens

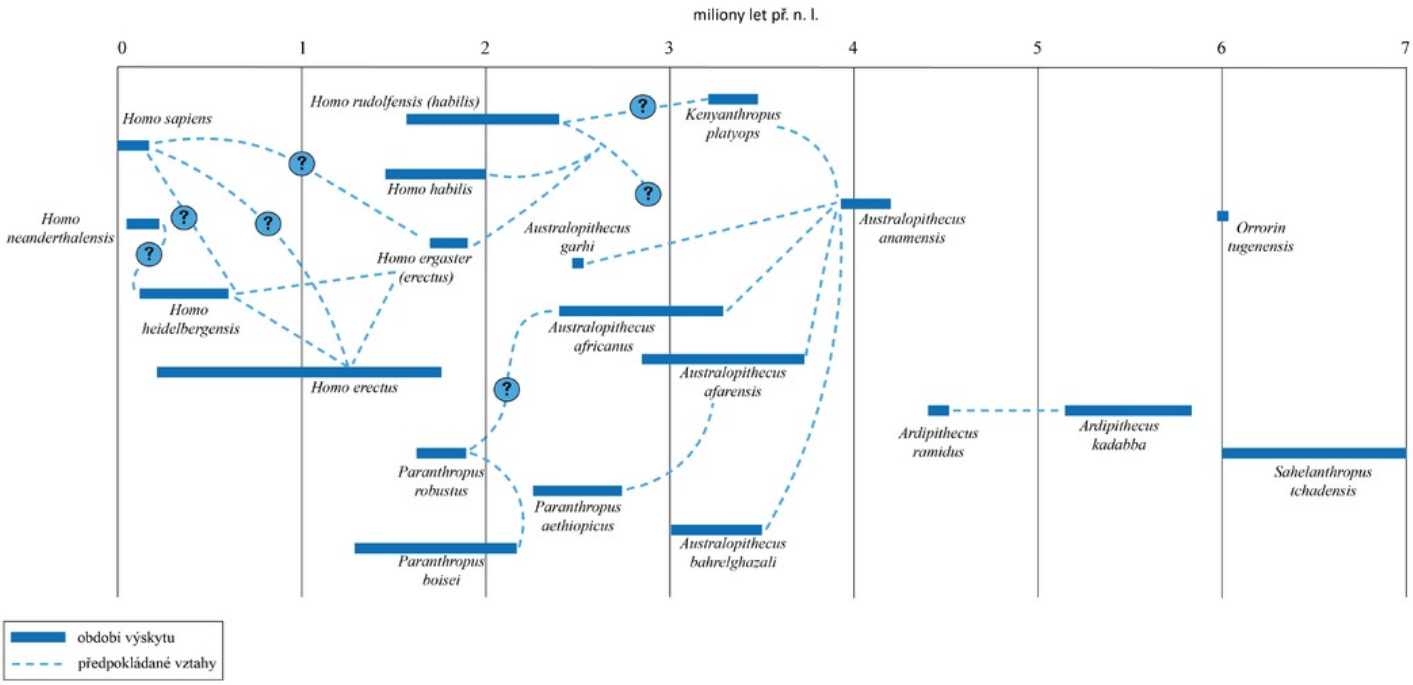
The first representatives of this species appeared about 200,000 years ago in East Africa. They were the closest to today's Maasai in terms of body constitution (tall, slender figure). The average brain volume in fossils found was 1500 cm^3, they hunted large game. In Europe and Siberia, after their settlement, the first dwellings (earthen houses) were documented. They were the first to dress (skin), communicate using articulate speech. Interbreeding with Neanderthals, who inhabited the cold regions of the north before the arrival of modern humans, may have contributed to adaptation to cold climates (see below). 40,000 years ago saw the emergence of visual arts, which is considered the first revolutionary act in human history to enable communication through surrogate material symbols.

The worldwide distribution of the species H. sapiens is explained by 2 hypotheses:

1. **Multiregional model of human evolution** - it was created not only in Africa, but also independently in Europe and Asia. This hypothesis is criticized mainly because of the heterogeneous conditions for (speciation). It assumes the spread of Homo erectus from Africa and its interbreeding with populations in newly reached locations. The modern form of this hypothesis assumes (gene flow) between populations and the spread of traits that originated in one place.
2. **Uniregional hypothesis** - the transition to new forms occurred in one place and from there these forms spread to other continents. This hypothesis does not exclude (gene flow) between populations.
   - This hypothesis is also supported by genetic studies. An example is the study of 2 neutral polymorphisms at the **locus CD4** on chromosome 12, where the frequency of haplotypes was highest in Africa and lowest in the Americas and the Pacific. Phylogenetic analyzes of mitochondrial DNA and Y chromosomal haplotypes also indicate the emergence of the species *H. sapiens* in Africa.

Today it is accepted that modern man (Homo sapiens) came out of Africa about 135-115 thousand years ago via the Arabian Peninsula, where the first interbreeding with the Neanderthals who inhabited it probably took place. Migration also took place back to Africa. Around 85,000 years ago, there was a great migration out of Africa and the gradual settlement of both Europe and Indonesia and the Sundanese via India, the northern route. Both American continents were the last to be settled via the Asian continent and across the Bering Strait.

Summary of the temporal context of species development (according to Encyclopedia Britannica)



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- Origin and evolution of species
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2. {{#switch: web |book = *Incomplete publication citation.* BAAB, K.L.. *Homo floresiensis: Making Sense of the Small-Bodied Hominin Fossils from Flores* [online] . Nature Education, Also available from <http://www.nature.com/scitable/knowledge/library/homo-floresiensis-making-sense-of-the-small-91387735>. |collection = *Incomplete citation of contribution in proceedings.* BAAB, K.L.. *Homo floresiensis: Making Sense of the Small-Bodied Hominin Fossils from Flores* [online] . Nature Education, Also available from <http://www.nature.com/scitable/knowledge/library/homo-floresiensis-making-sense-of-the-small-91387735>. {{ #if: |978-80-7262-438-6} } |article = *Incomplete article citation.* BAAB, K.L.. also available from <http://www.nature.com/scitable/knowledge/library/homo-floresiensis-making-sense-of-the-small-91387735>. |web = *Incomplete site citation.* BAAB, K.L.. Nature Education, [cit. 2017-01-08]. <http://www.nature.com/scitable/knowledge/library/homo-floresiensis-making-sense-of-the-small-91387735>. |cd = *Incomplete carrier citation.* BAAB, K.L.. Nature Education, [cit. 2017-01-08]. |db = *Incomplete database citation.* Nature Education, [cit. 2017-01-08]. <http://www.nature.com/scitable/knowledge/library/homo-floresiensis-making-sense-of-the-small-91387735>. |corporate_literature = *Incomplete citation of company literature.* BAAB, K.L.. *Homo floresiensis: Making Sense of the Small-Bodied Hominin Fossils from Flores* [online] . Nature Education, Also available from <http://www.nature.com/scitable/knowledge/library/homo-floresiensis-making-sense-of-the-small-91387735>. legislative_document = *Incomplete citation of legislative document.* Also available from URL <http://www.nature.com/scitable/knowledge/library/homo-floresiensis-making-sense-of-the-small-91387735>.
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References

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|book =

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ŠTEFÁNEK, George. *Medicine, diseases, studies at the 1st Faculty of Medicine, UK* [online]. [cit. 11/02/2010]. <https://www.stefajir.cz/>.

|cd =

ŠTEFÁNEK, George. *Medicine, diseases, studies at the 1st Faculty of Medicine, UK* [CD/DVD]. [cit. 11/02/2010].

|db =

Incomplete database citation. *Medicine, diseases, studies at the 1st Faculty of Medicine, UK* [database]. [cit. 11/02/2010]. <https://www.stefajir.cz/>.

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Incomplete citation of contribution in proceedings. PANCZAK, Ales, et al. 2013. {{
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Incomplete citation of contribution in proceedings. NCBI. Also available from <https://www.ncbi.nlm.nih.gov/gene/8924>. {{
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Incomplete article citation. NCBI. HERC2 HECT and RLD domain containing E3 ubiquitin protein ligase 2 [Homo sapiens (human)]. also available from
<https://www.ncbi.nlm.nih.gov/gene/8924>.

|web =

NCBI. *HERC2 HECT and RLD domain containing E3 ubiquitin protein ligase 2 [Homo sapiens (human)]* [online]. [cit. 2016-12-19].

<https://www.ncbi.nlm.nih.gov/gene/8924>.

|cd =

NCBI. *HERC2 HECT and RLD domain containing E3 ubiquitin protein ligase 2 [Homo sapiens (human)]* [CD/DVD]. [cit. 2016-12-19].

|db =

Incomplete database citation. *HERC2 HECT and RLD domain containing E3 ubiquitin protein ligase 2 [Homo sapiens (human)]* [database]. [cit. 2016-12-19].
<https://www.ncbi.nlm.nih.gov/gene/8924>.

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Incomplete citation of legislative document. Also available from URL <https://www.ncbi.nlm.nih.gov/gene/8924>.

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Incomplete publication citation. MACHOLÁN, Miloš. *Paleogenetics of man - will the analysis of archaic DNA cause a revolution in the view of human evolution?* [online] . Academia, 2014. Also available from <http://ziva.avcr.cz/files/ziva/pdf/paleogenetika-cloveka-zpusobi-analyza-archaicke-dn.pdf>.

|collection =

Incomplete citation of contribution in proceedings. MACHOLÁN, Miloš. *Paleogenetics of man - will the analysis of archaic DNA cause a revolution in the view of human evolution?* [online] . Academia, 2014. Also available from <http://ziva.avcr.cz/files/ziva/pdf/paleogenetika-cloveka-zpusobi-analyza-archaicke-dn.pdf>. {{
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Incomplete article citation. MACHOLÁN, Miloš. 2014, year 2014, also available from <http://ziva.avcr.cz/files/ziva/pdf/paleogenetika-cloveka-zpusobi-analyza-archaicke-dn.pdf>.

|web =

Incomplete site citation. MACHOLÁN, Miloš. Academia, ©2014. [cit. 2016-12-19]. <http://ziva.avcr.cz/files/ziva/pdf/paleogenetika-cloveka-zpusobi-analyza-archaicke-dn.pdf>.

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Incomplete carrier citation. MACHOLÁN, Miloš. Academia, ©2014. [cit. 2016-12-19].

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MACHOLÁN, Miloš. *Paleogenetics of man - will the analysis of archaic DNA cause a revolution in the view of human evolution?* [online] . Academia, 2014. Also available from <http://ziva.avcr.cz/files/ziva/pdf/paleogenetika-cloveka-zpusobi-analyza-archaicke-dn.pdf>. legislative_document =
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