Hominization

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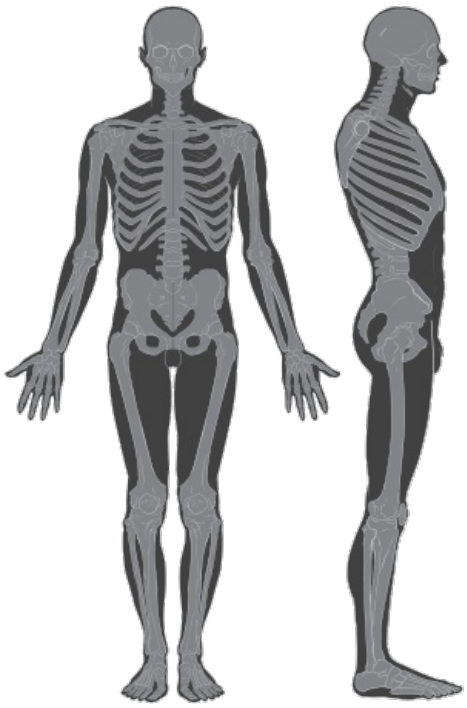
Hominization or humanization , is defined in anthropology as a process of gradual physical and social changes leading to the evolution of primates into humans (genus Homo).

Man as such is biologically and philosophically a completely new species, the result of the social and cultural evolution of the highest primates. The part of phylogeny including the development of modern man is referred to as anthropogenesis, which is associated with two processes − − **hominization** and **sapientation**. There is a significant difference between the two terms. By hominization we mean a set of changes observable on the human skeleton, i.e. changes physically distinguishing humans from apes. These changes include:

- expansion and flattening of the chest;
- shoulder girdle change, allowing arm rotation;
- changes in the pelvis, spine and entire lower limb in connection with bipedal movement;
- displacement of the occipital opening to the base of the skull;
- hand development;
- receding pubic hair;
- widening of the dental arch;
- increasing the capacity of the brain chamber and other changes on the skull (formation of the chin, receding of the supraorbital arches) − this process is followed by the sapientation process.

Note Sapientation is closely related to the development of the brain, its enlargement and gyrification. This enables the development of typically human features such as speech, abstract thinking (the second signal system) and the associated development of human society.



Skeleton of Homo sapiens

The process of hominization

We can divide the hominization process into three complexes:[1]

1. **the first hominization complex** − the pelvis and lower limb are rebuilt, it is related to the emergence and development of bipedalism; in the main features, this reconstruction is already achieved in the genus Australopithecus;
2. **the second hominization complex** - this refers to the reconstruction of the upper limb, especially the own hand, into an organ capable of making tools and working with them; this complex distinguishes the genus Homo from the genus Australopithecus (the former in Homo habilis;
3. **the third hominization complex** − in connection with the reconstruction of the skull and the development of the brain; this process lasted practically until the emergence of modern man, i.e. Homo sapiens.

However, the process of hominization can be structured differently in different sources. Authors of articles and professional literature may or may not include the process of sapientation in hominization. It also depends on the field in which the author works, a biologist will have one view of hominization, an anthropologist another, and a psychologist another.

Using another frequently used subdivision, hominization can be divided into another three complexes:

1. **chest and upper limb** − features common to humans and apes; the chest is barrel-shaped, slightly flattened and the upper limb very mobile;
2. **pelvis and lower limb complex** − features typical only for the Hominidae family, closely related to bipedal locomotion, this is the adaptation of the pelvis and the skeleton of the lower limb to this mode of movement;
3. **skull and hand** − this complex distinguishes the genus Homo from the genus Australopithecus, there is a significant enlargement of the brain part of the skull compared to the facial part and the completion of the morphology of the hand.

Interesting practical implications

The changes that led to the development of functional bipedia cause many health problems or diseases that accompany a person throughout his life. Interestingly, most of these problems are not found in any other organism known to us. These are typically human specifics.[2]

Childbirth

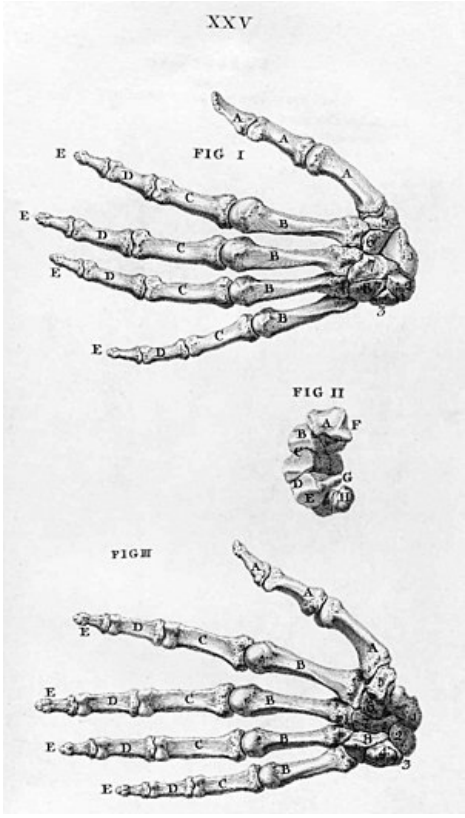
Already at birth, both the child and the mother are exposed to difficulties that we do not find elsewhere in the animal kingdom. The head of the fetus is almost as big as the opening it has to pass through. Due to the shape of the pelvis, childbirth is a rather difficult matter - the baby's head must turn 90% at one point, because the birth canal turns the same way, then it turns again in the same way. The stiff shoulders of a newborn, whose skeleton is inherited from monkey ancestors, are even worse. Because the baby comes from the mother facing away from her (which is the opposite of other primates), the mother has very limited opportunities to help the baby into the world. If she were to lean forward, the child could damage her spine by the pubic bone, or the child's ligament could also be broken. That is why mothers all over the world have always sought and are still seeking assistance.

In contrast, a young chimpanzee is born very quickly, its path is not hindered by a **narrowed birth canal, a twisting of its axis**, or an excessively **large head.** In addition, it is born in the "correct direction", so the female pulls it out herself. So why do human mothers have to suffer like this? Until the last century, childbirth was the most common cause of death for women of working age. Unfortunately, evolution is not able to create a perfect machine, it only uses natural selection to create a compromise that is most advantageous for the given environment.

Spine

Another important feature of a person is the **biaxially curved spine.** This element was also developed for better bipedal function, to align the center of gravity as precisely as possible above the lower limbs and thereby save energy released during movement. Thanks to this curvature, a person is able to walk long distances, stand upright and maintain stability, but it is also thanks to it that almost everyone suffers from **back pain** during their life.

The spine as such is originally constructed as an arch. In the human body, however, it fulfills the role of a supporting column, which bears great pressure, especially in the lumbar part. With great exertion, *disc herniation* can occur , and in later life, *spondylolysis* - 4-5% of the planet's population suffers from this health problem. In addition, even small deviations from normal physiology can cause great pain in the long term, which, in combination with overweight or obesity, can limit a person's movement. A good example is *scoliosis*, which arises especially when the muscle corset is insufficient or when carrying heavy loads. This disease occurs only and only in humans and their ancestors in the Hominidae family. A skeleton of a boy of the *Homo erectus species* was even found, who probably suffered from this disease. Back pain can be caused by excessive *lordosis* or *kyphosis* - that is, features that were created by evolution precisely as a defense against back and joint pain from constant forward bending during bipedalism.



Structure of the human hand

Knee joint

The transition to walking on two limbs had to be necessarily connected to the **strengthening of the bones and joints of the lower limb** and to changes in the **morphology of all important joints - hip, knee and ankle .**.

The knee is perhaps the most ingenious "invention" of natural selection in man. Thanks to its structure, humans are the only primates who can perfectly flex the knee joint. This allows walking and running in the way we know. When walking, the leg acts like an inverted pendulum, on a stretched knee the body seems to "swing" forward and thus the energy expended on tension is at least partially returned to the highest point on the way down. With this style, compared to other primates, humans save up to 65% of their energy when walking in pairs, while also protecting their joints from overheating.

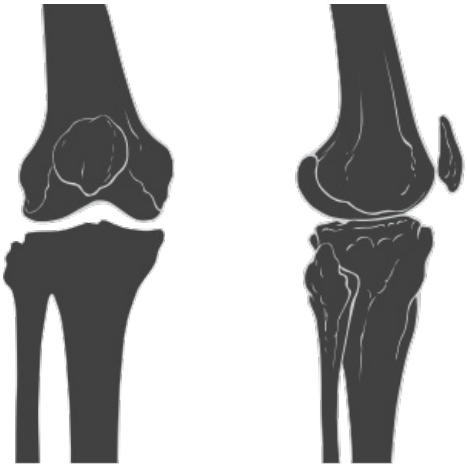


Diagram of the knee joint of Homo sapiens

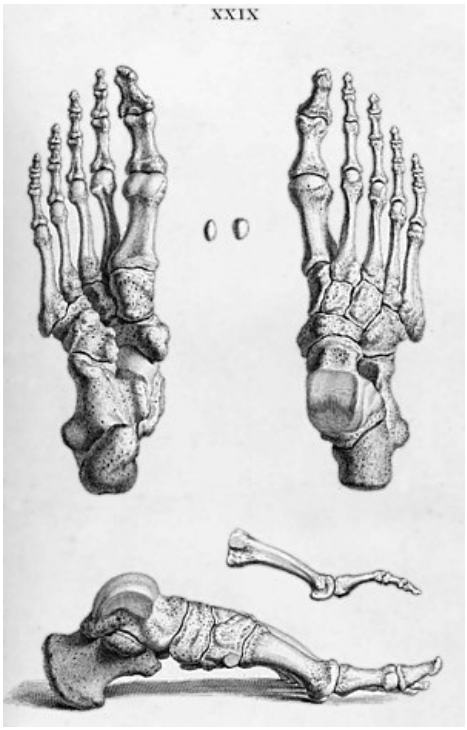
The same style of movement is the reason why, despite all the "improvements", the knee is excessively stressed, especially by the lateral pressure from the pelvis. The femurs are connected to the pelvis too far from the center of gravity, the knees, on the other hand, are positioned as precisely as possible below the center of the body for greater stability - thus the pelvis and knee joint cannot be connected "straight". This morphology causes a greater risk of knee dislocation and the occurrence of joint diseases such as *osteoarthritis*. A large number of patients then have to undergo a total endoprosthesis of the knee or hip joint. Logically, the risk is greater for women. Due to the wider pelvis, the angle at which the femur attaches to the knee joint is greater than in men, the lateral pressure acting on the joint increases proportionally, and the energy consumption required to move in pairs (walking, running) also increases. This also explains why women do not achieve such performances as men in running.

Foot

The most specific physiological feature of a person is, however, the foot. Hominization led to the **displacement of the thumb** to the other fingers and thus the loss of grasping abilities. Furthermore, a more complex **ankle joint**, connected to it by a strong **Achilles tendon** and also **larger calcaneus** , reinforced inside by cancellous bone tissue, developed. Morphological transformations of the foot and ankle, very rapid in terms of development, brought with them new diseases. Moreover, any small change in structure directly affects the entire organism, since all the weight of the body rests on these two relatively small surfaces.

The biggest problem is the **arch** of the foot. Among the most well-known diseases are *pes cavus* and *pes planus*, which then lead to other diseases. If there is even a slight deviation from the physiologically correct structure, the distribution of the body's weight changes, which can first lead to rapid fatigue when walking, calluses and blisters on the feet, and in worse cases to osteoarthritis of the ankle and then the knee, but also the big toe. Very often, people with flat feet have ankles turned to the inside of their feet and so-called *hammer toes* (digitus hammatus).

In the epiphyses of all joints, especially in the lower limbs, as well as in the calcaneus, due to the reduction in weight, cancellous bone tissue is present to a greater extent than in apes. Human bones are therefore more prone to *osteoporosis*, subsequent bone fragility and fractures. Lumbar vertebrae also suffer from a similar problem, in this case we refer to the disease as *spondylolysis*.



Structure of the human foot

Links

- ws: Hominizace

Related articles

- Evolution of the species Homo sapiens

External links

- Vznik a vývoj člověka (https://web.archive.org/web/20160402174551/http://genetika.wz.cz/vyvoj.htm)
- John Hawks weblog (http://johnhawks.net/weblog/) - Site of Associate Professor of Anthropology John Hawks, University of Wisconsin - Madison; many interesting articles and links
- Předchůdci člověka
- Evoluce člověka (https://nakladatelstvi.portal.cz/nakladatelstvi?id=4293)

Reference

1.
2.

References

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- BULISOVÁ, Jiřina. *Ottova všeobecná encyklopedie ve dvou svazcích. sv.[1]., A-L.* 1. edition. Praha. 2003. ISBN 80-7181-938-7.