Chapter 6: Human evolution.



What's wrong with this picture?

What is the history of human evolution?

Are we descending from apes? What's the difference between man and ape?

Let's answer these different questions.

I- Man and apes.

Man and chimpanzees are very close genetically (read DOCUMENT 1).

They mainly differ in the location of certain genes and in the chronology they're expressed.

As for great apes', human phenotype is acquired during the pre and postnatal development process under the influence of genetic instructions and environment (including relation with other individuals). (read DOCUMENT 2)

Even though we're really close, the few genetic differences lead to very different morphology and skeletons. (read DOCUMENT 3)

The age of the first primate fossils was estimated to -65 to -50 million years ago. They're all very different and no one is identical to actual Man or monkeys. Fossils teach us that the great apes diversity was once important. However, nowadays, it's much reduced.

Man and Chimpanzees share a common and recent ancestor. No fossil can be considered for sure as an ancestor of Man or Chimpanzees (because we lack information). (read DOCUMENT 4)

FLASHCARDS: Learn and check your knowledge on the topic https://quizlet.com/_6aomv2



Comparison of the human and chimpanzee karyotypes. The most significant difference is in Chromosome 2, which in the chimpanzee is made of two separate, smaller chromosomes. It is well-accepted that the combination of those two was the

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spark that led to the separation of the two families.

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Chimpanzee

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I.

Chromosomes marked * are noticeably smaller in the chimp than in the human. Arrows indicate a difference in the location of the centromere; in all cases, the chimp's centromere is closer to the center of the chromosome, and the human centromere is closer to the end.

Document 2: Fetal brain development in Chimpanzees and Humans

September 25, 2012 Kyoto University

The brains of humans increased dramatically after the emergence of the genus *Homo*. The brain size is much larger in humans than in other primate species.

Document a: Comparison of the brain prenatal development in Chimpanzees and Humans



The results of this research, led by a Japanese team, illustrate that the growth velocity of the brain volumes of chimpanzee foetuses does not accelerate during late pregnancy, whereas that of human foetuses does accelerate through late pregnancy. This indicates that human encephalization begins *in utero* and, so, that the **remarkable brain enlargement observed in the modern human brain starts during the fetal period**.

This difference is likely to be obtained in human lineage after the split of the two species following their evolution from a common ancestor.

Document b: Comparison of the postnatal development in Chimpanzees and Humans

Humans spend more than a decade developing into adults and learning, far more than the two or three years of chimpanzee adolescence.

That's why researchers have long suspected that developmental genes are involved in human brain evolution.

<u>Consequence</u>: This study highlights the importance of monitoring both prenatal and postnatal periods in efforts to promote the healthy growth of the minds and brains of children.



Document 3 : Human And Chimpanzee skeletons comparison



Document 4:Primate family trees.



The primate family tree showing representatives of its living members. Dates of divergence are approximate; mya: million years ago.

Man's place among Primates



Activities

Mandatory:

- 1- Write a text or make a record which will describe how document 2 explain the differences between chimps and humans.
- 2- Compare chimp and man skeletons and link their characteristics to the locomotion of these two species (document 3)

Optional:

3- Type bac: Chimps, Humans 96 Percent the Same, Gene Study Finds (writing or recording)

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Chimps, Humans 96 Percent the Same, Gene Study Finds

By Stefan Lovgren

PUBLISHED August 31, 2005

Scientists have sequenced the genome of the chimpanzee and found that humans are 96 percent similar to the great ape species

"Darwin wasn't just provocative in saying that we descend from the apes—he didn't go far enough," said Frans de Waal, a primate scientist at Emory University in Atlanta, Georgia. "We are apes in every way, from our long arms and tailless bodies to our habits and temperament."

Because chimpanzees are our closest living relatives, the chimp genome is the most useful key to understanding human biology and evolution, next to the human genome itself. The breakthrough will aid scientists in their mission to learn what sets us apart from other animals.

By comparing human and chimpanzee genomes, the researchers have identified several sequences of genetic code that differ between human and chimp. These sequences may hold the most promise for determining what creates human-specific traits such as speech.

[...]

To map the chimp genome, researchers used DNA from the blood of a male common chimpanzee (Pan troglodytes) named Clint, who lived at the Yerkes National Primate Research Center in Atlanta. Clint died last year from heart failure at the relatively young age of 24.

A comparison of Clint's genetic blueprints with that of the human genome shows that our closest living relatives share 96 percent of our DNA. The number of genetic differences between humans and chimps is ten times smaller than that between mice and rats.

Scientists also discovered that some classes of genes are changing unusually quickly in both humans and chimpanzees, as compared with other mammals. These classes include genes involved in the perception of sound, transmission of nerve signals, and the production of sperm.

Despite the similarities in human and chimp genomes, the scientists identified some 40 million differences among the three billion DNA molecules, or nucleotides, in each genome.

The vast majority of those differences are not biologically significant, but researchers were able to identify a couple thousand differences that are potentially important to the evolution of the human lineage.

"The goal is to answer the basic question: What makes us humans?" said Eichler.

Eichler and his colleagues found that the human and chimp sequences differ by only 1.2 percent in terms of single-nucleotide changes to the genetic code.

But 2.7 percent of the genetic difference between humans and chimps are duplications, in which segments of genetic code are copied many times in the genome.

"If genetic code is a book, what we found is that entire pages of the book duplicated in one species but not the other," said Eichler. "This gives us some insight into the genetic diversity that's going on between chimp and human and identifies regions that contain genes that have undergone very rapid genomic changes." Humans and chimps originate from a common ancestor, and scientists believe they diverged some six million years ago.

Given this relatively short time since the split, it's likely that a few important mutations are responsible for the differences between the two species, according to Wen-Hsiung Li, a molecular evolutionist at the University of Chicago in Illinois.

[...]

There are several hypotheses that account for the evolution of human traits. Li believes these traits come from changes in the parts of the genome that **regulate other gene activity**.

[...]

https://news.nationalgeographic.com/news/2005/08/chimps-humans-96-percent-the-same-gene-study-finds/

Present the recent study findings, then, use the text and your personal culture to explain why we call chimpanzees our closest relatives.