

DNA: Comparing Humans and Chimps

The chimpanzee and bonobo are humans' closest living relatives.

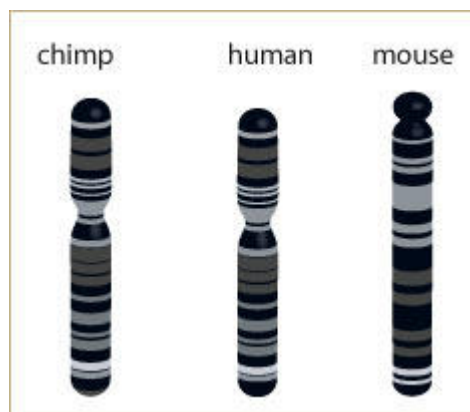


Photo: Adrian Sumner/Stone/Getty Images SEM image of human chromosomes, showing centromeres and chromatids (magnification: x6,100)

These three species look alike in many ways, both in body and behavior. But for a clear understanding of how closely they are related, scientists compare their DNA, an essential molecule that's the instruction manual for building each species. Humans and chimps share a surprising 98.8 percent of their DNA. How can we be so similar--and yet so different?

So Much Alike...

Human and chimp DNA is so similar because the two species are so closely related. Humans, chimps and bonobos descended from a single ancestor species that lived six or seven million years ago. As humans and chimps gradually evolved from a common ancestor, their DNA, passed from generation to generation, changed too. In fact, many of these DNA changes led to differences between human and chimp appearance and behavior.



Examine the Evidence

Matching DNA? Human and chimp DNA is nearly identical when you compare the bands on chromosomes, the bundles of DNA inside nearly every cell. Which two chromosomes are more alike?

Banding Patterns

The light and dark bands on these chromosomes, created by a laboratory dye, reveal similarities and differences among human, chimp and mouse DNA.

Human and chimp X chromosomes both contain about 1,100 different genes, or sets of instructions. Each gene affects a particular trait in the body.



© AMNH / Rod Mickens Chimp eyes and human eyes

HEM B - Blood clotting, hemophilia
CPX - facial development, cleft palate
SMC1L1 - chromosome maintenance
OPN1LW - red color vision

Seeing Red

Most genes in humans and chimps are nearly identical. Both species have the OPN1LW gene, which allows them both to see the color red. But mice lack OPN1LW--and have trouble seeing red.

...And Yet So Different

If human and chimp DNA is 98.8 percent the same, why are we so different? Numbers tell part of the story. Each human cell contains roughly three billion base pairs, or bits of information. Just 1.2 percent of that equals about 35 million differences. Some of these have a big impact, others don't. And even two identical stretches of DNA can work differently--they can be "turned on" in different amounts, in different places or at different times.



Photo: Nick Koudis/Photodisc Green/Getty Images Human eyes

Same Genes, Behaving Differently

Although humans and chimps have many identical genes, they often use them in different ways. A gene's activity, or expression, can be turned up or down like the volume on a radio. So the same gene can be turned up high in humans, but very low in chimps.

The same genes are expressed in the same brain regions in human, chimp and gorilla, but in different amounts. Thousands of differences like these affect brain development and function, and help explain why the human brain is larger and smarter.

Slightly Different Genes

The chimpanzee immune system is surprisingly similar to ours--most viruses that cause diseases like AIDS and hepatitis can infect chimpanzees too. But chimps don't get infected by the malaria parasite *Plasmodium falciparum*, which a mosquito can transmit through its bite into human blood. A small DNA difference makes human red blood cells vulnerable to this parasite, while chimp blood cells are resistant.

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