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Chimp, human DNA comparison finds vast similarities, key differences

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An international team of 67 scientists, led by a top genome researcher in Seattle, may have moved us a few steps closer toward figuring out precisely what in the genetic code makes us human -- or, at least, not chimpanzees.

"By comparing the human and chimp genomes, we can see the process of evolution clearly in the changes (in DNA) since we diverged from our common ancestor," said Robert Waterston, director of genome sciences at the University of Washington and lead author of a report on the project in today's edition of the journal Nature.

Humans and chimps each have some 3 billion base units of DNA in their genomes, differing by only 1.2 percent when compared in this way. Other methods of comparison estimate a genetic difference of at most 4 percent.

UW researchers Evan Eichler, left, and Robert Waterson co-authored a new paper analyzing the chimpanzee genome. The photo in the background depicts Port, a chimpanzee at the Gombe National Park in Tanzania.

"We're not that different," Waterston said.

But we have language, cars, espresso machines and psychotherapy. How could all that result from just a comparatively small number of genetic changes in the overall blueprint?

Waterston acknowledges that scientists are a long way off from answering such questions. But we're getting closer, he says. He noted one gene, known as FOXP2, that may help explain why we talk and chimps don't. An earlier study of a British family with an inherited, severe deficit in speech discovered the cause of the disorder -- an altered form of FOXP2.

"It turns out chimps have the same (genetic) sequence as that family with the speech deficit," Waterston said. Comparing the human and chimp genomes, he said, shows that the speech-friendly form of FOXP2 really took hold in humans some 150,000 years ago.

"That gene went through a selective sweep," said Evan Eichler, a co-author and top genome scientist who recently joined Waterston at the UW. That's genome-speak, Eichler explained, for saying that those humans who got the chatty form of FOXP2 went on a reproductive binge and overwhelmed those who remained genetically at a loss for words.

The researchers, known as the Chimpanzee Sequencing and Analysis Consortium, took the human genome sequence -- a first draft of it was completed in 2001 -- and compared it with the 3 billion bits of DNA obtained from a blood sample taken from a chimp named Clint at Emory University's Yerkes National Primate Research Center in Atlanta.

Waterston launched the project, supported by the National Institutes of Health's National Human Genome Research Institute, when he was still at Washington University in St. Louis. Much of the sequencing work was done there, as well as at the Massachusetts Institute of Technology and at Harvard University.

The scientists did find differences. Out of the 3 billion units of DNA, the human-chimp comparison revealed some 35 million simple changes, or mutations, in the single units of the overall sequence. They also found about 5 million additions to or subtractions from the genome involving chunks of DNA sequence.

"We can use these to identify evolutionary events," Waterston said. The changes, he said, also help point them toward the exact sequence of the common ancestor. And of the 25,000 genes both species have, only about 580 genes appear to have undergone the kind of "positive selection" seen with FOXP2. Many are likely to be critical in differentiating the two primate species, he said.

But it will be further analyses and in-depth comparisons of the genomes of many different species that bring us closer to determining what precisely it is in our genes that makes us humans.