

## ONLY A THEORY?

Sometimes evolution is dismissed as “only a theory” – a “guess” or “conjecture.” But scientists use the word “theory” in a very different way. We begin with educated guesses (*hypotheses*) based on evidence from nature. After much scrutiny and testing, we formulate a broad explanatory framework that makes sense of multiple lines of evidence, called a *theory*, which is continually refined and tested as progress is made. A good theory makes risky predictions which – if they fail – could adjust the theory, or even lead us to reject it. Technically speaking, scientists never *accept* a theory as “proven”; rather, we only *fail to reject it*. On the one hand, all scientific theories are provisional (in some sense): we can’t be 100% certain that a given theory won’t be rejected one day. On the other hand, some theories are so productive, and so extremely well supported (e.g. heliocentrism), that it’s very unlikely that new evidence will shift our views very much.

## SAME GENES, SAME ORDER

Some of the most powerful examples of evolution as a productive theory come from *genomics* – a branch of biology that investigates complete sets of DNA for different organisms. Completed in 2003, the Human Genome Project allowed us to understand, catalogue, and *sequence* all the genes in human DNA. We can now compare those sequences, letter by letter, to other species – especially other species that we already thought were related to us based on embryology, the fossil record, anatomy, etc.

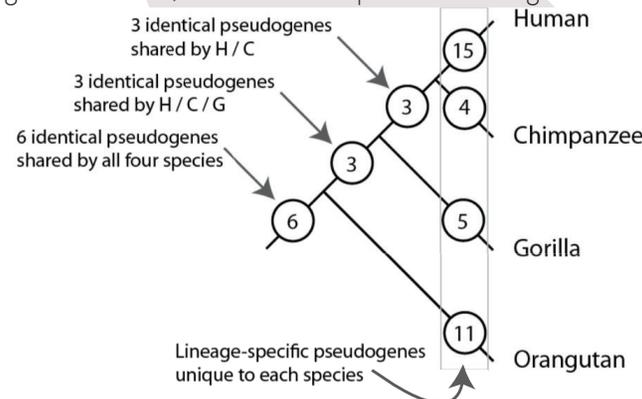
When compared side-by-side, the human and chimpanzee genomes are approximately 95% identical, DNA letter-for-letter. (Sometimes the percentage is reported a bit differently, but the point is that they are significantly identical.) If we imagine two libraries, one for humans and one for chimps, then 95% of the books are the same in both. If you move a book from one shelf to another, its meaning does not change. The same goes for genes: the arrangement makes no difference (in the vast majority of cases); they still mean (or do) the same things. And for humans and chimps, not only do we have the same “library,” with the same “books,” but we have the same books in (almost) *the same order*. (There are some minor changes because things can move around a bit.) They don’t need to be in the same order, but they are.

These two genomes are exactly what we’d predict if they both evolved from the same ancestral genome. Charles Darwin knew nothing of DNA. If you had told him that there was a heritable genetic code in each organism, with patterns of evidence to support what he was already saying based on other evidence, he would’ve done backflips!

## PSEUDOGENES

Like pages torn out of a book, some mutations destroy a gene’s message but leave large portions of structure intact. We know we’re looking at the remnants of a gene (called a *pseudogene*) – the same way we still recognize a book with missing pages. When we compare the human genome with those of chimps, gorillas, and orangutans, we notice something interesting: not only a surprising amount of the same genes in the same order, but also *exactly identical mutations* in many genes and pseudogenes – right down to the DNA letter. A non-evolutionary hypothesis could be that the exact same mutation happened, *independently*, in each separate lineage. In contrast, evolutionary theory would predict that this mutation happened in a common ancestral species, which was then inherited as populations went their separate ways.

One study looked at shared genetic errors in olfactory pseudogenes (Y. Gilad, et al.). Here we see some mutations unique to a specific lineage: in the figure, we have 15 mutations unique to humans; 3 *identical* errors shared between humans and chimps *only*; another 3 between humans, chimps, and gorillas; and 6 between all four species. What we *don’t* find (at least in this small sample) is just as telling: e.g., we’re *not* seeing any mutation present in both orangutans and humans, but absent from chimps and gorillas. Rather, if a mutation is present in orangutans and



humans, we find the *same mutation* in chimps and gorillas. This is just the kind of pattern we’d expect if all four species do, in fact, share one prior ancestral population. This new genetic evidence provides independent support for the “family tree” predicted earlier (based on fossils, etc.)!

Another example uses chickens (D. Brawand et al.). Evolution strongly predicts that placental mammals, like humans, share a common ancestral population with egg-laying animals, like birds, about 310 million years ago. The prediction is that we today are highly modified egg-laying organisms. To test this, one research group looked for the remains of egg yolk production genes (called *vitellogenins*) in humans. Comparing the two genomes, they located three vitellogenins in chickens (VIT1, VIT2, & VIT3), recorded which other genes were nearby in chickens (ELTD1, SSX2IP, & CTBS), and then located those other genes in the human genome. When they looked for remnants of egg-yolk producing genes nearby, they found them! (The black bars between the chicken and human genomes represent matches between the two.) Humans actually have small, fragmentary remains of egg-yolk producing genes still functioning in chickens.



## SUMMARY

Is evolution “only a theory”? If we’re asking whether it’s a well-tested explanatory framework, supported by a large body of experimental evidence, that makes highly accurate predictions, and that has not (yet) been falsified through experimentation, then yes! We’ve had evolution as a productive scientific theory for over 150 years, and we have not yet rejected it. These genomic patterns strongly agree with independent lines of evidence for evolutionary theory – from the fossil record to embryology. If evolution had not already been a theory prior to genome sequencing, this alone would have brought the idea to the fore.

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As Christians, we accept that God works through what we perceive as “natural,” as well as through supernatural means – both are forms of divine action, requiring the ordaining and sustaining action of God. The idea that God uses evolution as a creative mechanism is increasingly being recognized as one of the faithful options for evangelical Christians, and resources for this view are becoming more widely available (e.g. BioLogos.org).✿

## FIND OUT MORE

D. Brawand, W. Wali, and H. Kaessmann, “Loss of Egg Yolk Genes in Mammals and the Origin of Lactation and Placentation,” *PLoS Biology*, 6 (2006): 507–17.

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Dennis Venema, BioLogos Blog Series. [biologos.org/author/dennis-venema](http://biologos.org/author/dennis-venema)

Dennis R. Venema and Scot McKnight, *Adam and the Genome: Reading Scripture after Genetic Science* (Brazos Press, 2017). See also: “Adam & the Genome,” CSCA YouTube Channel ([csc.ca/youtube](http://csc.ca/youtube)).

Dennis R. Venema, “Genesis and the Genome: Genomics Evidence for Human-Ape Common Ancestry and Ancestral Hominid Population Sizes,” *Perspectives on Science and Christian Faith*, 62(3) (2010): 166-78.

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## “Faith and Science, eh?”

## Genomic Evidence for Evolution



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