



Creationist Funhouse, Episode Six

God the Biotechnologist

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To God, biotechnology must seem like child's play. Previously in this series, I have explained how, in order to conform with creationist beliefs, God had to manipulate all the rocks and fossils, and even the light from distant galaxies, to make a young, miraculously created universe *look* like an old, evolved one. But perhaps his most amazing accomplishment is that he manipulated the DNA of every species of organism in the world to make it look as if evolution has occurred. Take *that*, Francis Collins and Craig Venter!

DNA is the molecule found in almost every cell that stores the genetic information telling the cell what to do. Nearly every chemical reaction that occurs in every cell of every organism is controlled by enzymes, whose structure is encoded in the DNA. All the structures, from fins to feathers, from guts to nuts, and everything that happens inside them, is controlled by the DNA of the genes.

DNA encodes information in the sequence of the four bases A, C, T, and G (let's skip the chemical names). That is, it uses an alphabet of four letters. What this means for evolutionary studies is that, when a certain gene is shared by more than one species, the similarity of structure of the genes can be calculated by comparing the base sequences.

Some genes are found in nearly every species of organism. An example is the group of genes that code for *hexokinase*, which is the enzyme that controls the very first step in the metabolism of the sugar glucose. This is a reaction that occurs in nearly all cells, from bacteria to plants to humans.

Other genes occur in a more limited range of organisms. For example, the genes for the enzyme *rubisco* that functions in photosynthesis are found only in photosynthetic bacteria, algae, and plants. Some genes, such as those that control the development of the large cerebral cortex in the human brain, may be unique to our species.

There is an evolutionary pattern to the DNA, in two ways. First, species that are more similar to one another share more of the same genes than do species that are less similar, as in the examples above. Second, the base sequence of shared genes is more similar in closely related species, such as different species of primates, than in distantly related species, such as mammals and insects. Humans are about 98 percent genetically similar to chimpanzees; less similar to gorillas; even less similar to monkeys; even less similar to cows; and so on. The same is true of DNA sequences that, while not themselves genes, control the expression of genes.

From a creationist perspective, God made all the different species, and each of them has different anatomy and physiology. If this is so, then similar species would have similar genes, and dissimilar species would have dissimilar DNA. Their anatomy is different, their physiology is different, so their DNA must be different as well. No surprise here.

What *is* surprising is that your chromosomes carry not only the genes that you use but also genes that have been deactivated. You do not use them, but they were used by your evolutionary ancestors—which, therefore, you had. These in-

activated genes are called *pseudogenes*. You could call them fossil genes or dead genes. This means you carry around fossil evidence for evolution inside your chromosomes!

One interesting example is *olfactory pseudogenes*. Olfactory genes code for the proteins that bind with and recognize volatile chemicals in the air. These proteins allow the sense of smell and are found, not surprisingly, in the noses of animals. This is not the same as the tongue's sense of taste, which is limited in humans to salt, sweet, sour, bitter, umami, and (believe it or not) water. When you have a cold, you lose your sense of smell, not taste. Most flavor is scent, not taste, and we have our olfactory proteins to thank for this.

Mammals have about a thousand olfactory genes. Mice have about 1,200 olfactory genes. About 25 percent of these genes have been inactivated; they are pseudogenes. So mice use about 75 percent of their olfactory genes. Humans have about 850 olfactory genes, of which we use only 45 percent. That is, about 55 percent of these genes have been inactivated. This suggests that mice can distinguish about twice as many scents as we can, whether they are simple scents, such as vanilla, or more complex mixtures of odors, such as chocolate. Olfactory sensitivity results not only from how many kinds of olfactory proteins an animal uses but also how many of each the animal has. Even for sets of molecules that both humans and dogs can smell, dogs can smell them at much lower concentrations than we can, because they have more receptors—fifty times as many as we have.

How did the olfactory pseudogenes get there? The only reasonable explanation is that our evolutionary mammal ancestors had and used over a thousand olfactory genes, but in our evolutionary lineage many of them have since become inactivated. This is because most mammals navigate the world using scents, but many primates rely primarily on sight to find food. When random mutation inactivated an olfactory gene, making it into a pseudogene, it didn't make as much difference to a primate as to, for example, a dog.

But what if you did not evolve? Then it must have been that God created not just your living genes but also slipped a

bunch of dead pseudogenes into your chromosomes as well. And not just any dead genes, but dead genes *that more closely resembled those found in species similar to you than in species different from you*. Just as your genes more closely resemble those of a chimp than of a dog, so also do your pseudogenes. This would be odd, from an anti-evolutionary viewpoint, because if a pseudogene has any function at all, that function is unrelated to its original base sequence.

Consider the example shown in the illustration below. It shows six pseudogenes found in primates. One of them, the one that is estimated to be 36 million years old, is found in all six species. Two other pseudogenes, the ones that originated 21 to 25 million years ago, are found in apes and Old World monkeys. Capuchin monkeys, being New World monkeys, do not have them. The New and Old Worlds had already separated by that time by continental drift. The 19-million-year-old pseudogene is found only in apes, which are found only in the Old World. The two youngest pseudogenes are found only in humans, chimps, and either gorillas or orangutans. Creationists have no explanation for this pattern, which perfectly fits what is known from evolutionary history.

The main way that complex cells get rid of old genes is by making them into pseudogenes rather than by cutting them out and throwing them away. DNA is digital information, just like that on a computer disc. When you delete a file on a computer disc, the file is still there. The only thing that has been deleted is the little bit of code that tells the computer where to find the file. The file is still there, lost and inaccessible to everyone except the FBI. The human genome, just like your hard drive, carries around a lot of useless, and generally inaccessible, old files.

In addition to the olfactory pseudogenes, your chromosomes contain hidden DNA sequences for hairiness (the hHaA pseudogene) and for a tail (the WNT3A pseudogene). The reason most mammals are hairy and you are not (well, most of you) is that a DNA sequence that codes for hairiness is very active in other apes and less active in you. The reason you do not have a long tail, even though all mammals have

Pseudogenes in six species of primates

Pseudogene	Estimated Human age (millions of years)	Human	Chimp	Gorilla	Orang-utan	Rhesus monkey	Capuchin monkey
α -Enolase Ψ_1	11	•	•	•			
AS Ψ_7	16	•	•		•		
CALM II Ψ_2	19	•	•	•	•		
AS Ψ_1	21	•	•	•	•	•	
AS Ψ_3	25	•	•	•	•	•	
CALM II Ψ_3	36	•	•	•	•	•	•

Humans share all the same pseudogenes with chimps, with whom we share the most recent common ancestor; we share fewer with Old World monkeys and even fewer with New World monkeys. From Friedberg, Felix, and Allen Rhoads. 2000. Calculation and verification of the ages of retroprocessed pseudogenes. *Molecular Phylogenetics and Evolution* 16 (2000): 127–130.



Credit: Loraine Thompson

genes for it, is that your tail genes are less active than it is in apes and other mammals. Monkeys have long tails, while you just have a coccyx.

But the inactivation of genes takes time. To fit into a creationist time scale, God had to put inactivated hair, tail, and olfactory genes right into Adam and Eve.

There is another possibility. A creationist might say that maybe, just maybe, Adam and Eve used these genes but the genes were subsequently inactivated, perhaps at the time of The Fall. Try to imagine this conversation between Adam and Eve:

“Hey, Eve. Nice tail!”

“You too, guy.”

“And your furry back. It drives me wild, woman!”

Even spookier than this is human endogenous retroviruses, or HERV. Today, there are some viruses that can insert themselves into our chromosomes. The most famous one is HIV. Hidden inside chromosomes, the HIV genes can trick your cellular machinery into making more HIV viruses. Sometimes, such viruses can get into the germline and get passed on from one generation to the next. But if they do so, they are likely to be degenerated. They are still there but cannot spread. They just sit in chromosomes and get copied over and over. They are viruses that your evolutionary ancestors had—ancestors that you, therefore, had. HERV now make up 5–8 percent of your DNA, which is at least as much as your actual genes. Your chromosomes carry not only fossil genes but fossil viruses. Why would God have put them there? The Bible doesn't say anything about them.

Those pseudogenes came from somewhere. To a creationist, either God had to slip them in after he created all the

genes or else he had to inactivate a lot of the genes that he had originally created. And he had to do this in a way that made your pseudogenes more closely resemble those of apes than of monkeys, of monkeys than of dogs, of dogs than of birds, of birds than of fish, of fish than of plants. And none of this amazing biotechnology is mentioned in the Bible. It is all creationist imagination.

Pseudogenes are just *vestigial* genes. For centuries, scientists have known about vestigial organs, structures that appear to serve no function in a modern organism, although they functioned in the organism's evolutionary ancestors, which they, therefore, had. Examples include the human appendix, which is an atrophied version of the caecum that is much larger in other mammals. Floral staminodes are also vestigial. The stamens of flowers produce pollen in a sac on a stalk; the staminode is just the stalk. *Vestigial* does not necessarily mean *useless*. The appendix might be useless. Chances are, if you have had yours surgically removed, your ability to get along in life has not been appreciably diminished. But staminodes, while sterile, are not useless. They can be colorful and help a flower to attract pollinators.

Let me end with one of the most interesting examples of a phenomenon that can be reasonably explained only by evolution. Modern birds do not have teeth, although they may have ridges on their beaks that allow them to hold onto food items. A beak is, more or less, hardened gums. But they do have pseudogenes for teeth. Decades ago, two scientists figured out how to reactivate tooth pseudogenes in a chicken. The result was a chick with teeth—the first bird in sixty million years to have teeth. The teeth did not emerge through the beaks, but they were there, and you can see a picture of one of these teeth in the February 29, 1980, issue of *Science*. Creationists believe that God made all the birds. Some of them, now extinct, had teeth. But why do the others have tooth pseudogenes? Did God put them there just to trick us into believing in evolution?

Once again, the conclusion is not simply that “creationists are wrong,” which we already knew. Rather, I hope to open your eyes to fascinating new things. Until I studied pseudogenes, I had no idea that I was carrying around fossils inside my own chromosomes.

In the next article, we will explore another evolutionary oddity that, from the creationist viewpoint, has no reason to exist and the adventure that led biologist Lynn Margulis to discover it.



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