Chapter 15. Common Ancestry—The Second Biggest Idea Ever

All the organisms in the world, from the smallest virus to the largest tree, are the evolutionary descendants of one ancestral organism, or population of organisms.

Meet LUCA

Its name was LUCA. At least, that's what scientists call it. It lived about three and a half billion years ago. The letters stand for Last Universal Common Ancestor. It was not necessarily the first life form. It may itself have had ancestors. But any other evolutionary lineages that might have sprung from LUCA's ancestor have become extinct.

If you imagine possible universes, you can see that it doesn't have to be this way. A Creator could have started off with many independent and distinct types of organisms, and according to most creation mythologies this is exactly what happened. There is not even a particularly good reason that life on any planet had to have just a single evolutionary origin—unless, that is, the origin of life was such an improbable event that it could not have happened twice on any given planet. If life did come into being, say, three times on this planet, however, the descendants of the other two have become extinct.

Or so we think. As scientist Peter Ward points out, how exactly would we know? What if these significant others lived someplace we cannot go or are too small for us to see? The most common way that we detect the presence of microscopic life forms is by amplifying their DNA. But what if these other life forms do not have DNA? It seems extremely unlikely that they exist, but somebody may discover them someday, and I would be a fool to claim that they cannot possibly exist.

So what was LUCA like? Many scientists think that if you saw LUCA today, you would think it was a bacterium. But you certainly can't find LUCA today. All evolutionary lineages have continued to evolve and evolve and evolve. Their external appearances may not have changed all that much over the last three and a half billion years, but their DNA has kept changing. There is more DNA diversity among organisms that most of us call "bacteria" than there is among all other kinds of organisms put together. But they still just look like bacteria.

One thing that is reasonably certain is that LUCA stored its genetic information in DNA. All cells today do this, so it is reasonable to believe that LUCA did. DNA could not, however, have been the first genetic storage mechanism. Some simpler way of storing genetic information must have preceded it, for example, a related but simpler kind of molecule called RNA. LUCA's ancestors might have used RNA, and then evolved the DNA system which they added to the RNA system that they already had. In fact, all cells still do this. Every cell stores genetic information as DNA, but then uses RNA to put that information to use. RNA molecules, and even structures known as ribosomes, which are found in every cell, may be leftovers of the ancient world (often called the "RNA world") of LUCA's ancestors. It seems likely that something even simpler preceded RNA.

Before we go further, consider the things known as viruses. I say "things" because whether they are organisms or not depends on your definition. They are certainly not cells. They appear to be complex clusters of molecules that can induce true cells to make copies of them. Biological viruses are like computer viruses: they are stray bits of software, useless without computer hardware to put their genetic instructions to use. For this reason, viruses probably originated (many times) as fragments of DNA or RNA. So LUCA was not a virus.

Appearances aside, you have many resemblances to LUCA. Your cells, like LUCA, store genetic information in DNA; use genetic information via RNA; and do so through virtually the same code. Your cells have almost the same kind of membrane around them. Even many of the basic metabolic reactions are the same, in particular the early stages of releasing chemical energy from sugar. Only later did some of LUCA's descendants evolve the ability to use oxygen (and some didn't); or the ability to make food from sunlight (and some didn't); to package DNA into a nucleus with chromosomes (and some didn't). But clearly one of the greatest ideas of all time is that all life forms are a single evolutionary lineage.

This means that research on one kind of animal can allow us to draw conclusions about another kind of animal, in some cases. In particular, we can learn things about humans by conducting experiments on other animals that would be unethical, even absurdly immoral, to conduct on humans. Here is an example.

Fruit Fly Hangovers

It seems to be common knowledge that, among humans, sexually-frustrated males seek alcohol. But it turns out that this desire and its resulting behavior pattern are hundreds of millions of years old. Male fruit flies display this same behavior.

Scientists like to work with fruit flies. This is because they are easy to raise in little plexiglass vials. The maggots eat a special chow made from dried fruit (it smells vaguely like banana). When the pupae hatch, they can mate and lay eggs in the chow. When the flies hatch, the scientists can take then out of the vial and put them in another. In this way, scientists can control which flies mate with which other flies. Flies are apparently not choosy, and will mate with whichever other flies the scientists put them with—even with "test-cross" flies that have lots of weird recessive mutations. But I might mate with strange females if I knew that I was only going to live for two weeks and that I would never get out of that damned vial. Flies do not actually *know* they are only going to live two weeks, but evolution has selected them to act as if they do. In addition, the genetics of fruit flies is very well understood. But here is the most important reason scientists work with fruit flies: they in fact share with humans many genes of great interest, including some implicated in neurological disorders such as autism. Of course, flies cannot be autistic, but they can have the genes that make humans autistic.

This is how a group of scientists found out that male flies crave alcohol when they experience sexual deprivation.[1]It turns out that female fruit flies that have just mated will reject the advances of new males. The researchers produced two groups of male flies. The males in the first group—let's call them the frustrated group, although scientists will avoid such terms for animals that may not actually have those feelings—were placed in vials with recently-mated females, who rejected them. The males in the second group—the happy group—were placed in vials with not just one but lots of receptive virgin females. More polar opposites could not be imagined, even for fruit flies: the males forced into abstinence, and the males partying in a harem.

The researchers then offered a choice to the males from the two groups: they could either eat food with, or without, added ethanol. The flies could eat the food from little tubes from which the quantity of food consumed could be easily measured. The two kinds of tubes were intermixed. When the researchers ran the experiment, they found that the frustrated flies chose the ethanol-enhanced food more often than did the happy flies.

Now the question arises, are the flies frustrated due to sexual deprivation, or to active rejection? To answer this question, the researchers had to use female flies that neither mated with the males nor actively rejected them. That is, a female fly that would just sit there unresponsively. They did this by letting male flies encounter unmated *decapitated* female flies. It didn't seem to matter whether the males had been rejected or merely deprived; they behaved as if they were equally frustrated.

What is going on here? Apparently there is a brain chemical called neuropeptide F, which sexual deprivation reduces, but which ethanol enhances. The researchers even measured NPF levels in fly brains. The researchers published color images of the fly brains lighting up, or not, with this chemical. Humans have a similar brain chemical called neuropeptide Y. In flies, as in guys, ethanol compensates for sex, at least on the neuropeptide level.

Based on the examples I have given you here and in earlier chapters, you can be forgiven for thinking that scientists love to torture animals—breaking ant legs, decapitating flies, poking mice, gluing spider mouthparts shut—but we are not all like that. I only torture plants. I pull off their leaves, rip them to pieces, grind them up, soak their little twigs in alcohol…oops, I'm getting carried away. It must be that apricot beer I'm drinking. Little fruit flies are buzzing around it. I thought it was the apricot essence, but it must actually be the alcohol that attracts them.

It is easy to cite these examples, especially the DNA similarities among all organisms, as proof that life evolved rather than being created by a higher power. Surely this Higher Power would not have used the very same biochemical processes in all of these different life forms? But not so fast. This Creator might, for some inscrutable reason, have chosen to use the same motif over and over, even if every group or organisms (or even every species) was created separately. This is unsatisfying, but cannot be disproven.

Human industry follows an evolutionary pattern. Every year, new models of cars come out, but they are seldom redesigned from the ground up. Even the new little electric cars resemble older cars in most respects. There is a good reason for this. No company could afford to start entirely from scratch every year or even every decade. But an omnipotent Creator could, one would think, start over again with a new design as often as that Creator desired.

Back when I was a creationist, I had what I still think was a better explanation. If all of these life forms were going to interact in a gigantic food web—which they do—then the Creator would have given them all the same fundamental biochemical processes, so that they can eat each other. This includes the microbes that decompose other organisms that have died. This explanation is far from perfect but is better than what creationists generally have to offer as their version of why all of us species look, at least at the cellular level, like they have a common ancestor.

The Big Idea of common ancestry makes me feel at home on Earth. I am not a spirit mudded down with a material body, nor am I a poor wayfarer wandering on a planet of mud which is—trees no different from rocks—the stage upon which the human drama is being played. Trees are my distant cousins; rocks are not.

But even the rocks are part of a living planet. The rocks, unlike me and the trees, did not evolve. But they are part of a totally interconnected and living planet. This is the third big idea.

Endnote

1. Shohat-Ophir, G., et al. “Sexual deprivation increases ethanol intake in *Drosophila*.” *Science* 335 (2012): 1,351-1,355.