

Evolution -- Cosmic and Biological
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Covalence (April 16, 2005)

How are Christians to view the scientific realities of cosmology and biological evolution? We need to know the basic facts and theories of physics and biology, but we also need an adequate theological standpoint from which to view science. I must be brief here, and will eschew all the scholarly apparatus of footnotes etc. (My book *The Cosmos in the Light of the Cross*, and an earlier article in *Covalence* IV.2, "Intelligent Design as a Theological Problem," go into greater detail and provide references.) Let's begin here with an appropriate context in which to put these matters, the theology of the cross.

Calvary is where we know God in the greatest depth. Luther said that the true theology is that of the cross because that is where we recognize the true God. But God is paradoxically hidden even in the revelation in the cross, so we should expect that God's presence and activity in the world will generally be hidden. And if that is the case God will not be observable by scientific means, and will be unnecessary for scientific explanations of the world, even though God is continually present and active. God, Bonhoeffer said, is willing to be pushed out of the world and onto a cross.

What are the implications of this view for God's action in the world, the subject of traditional doctrines of providence? There are three components of a view of divine action which is in accord with such a theology.

First, God cooperates with natural processes. Creatures are the instruments with which God works. In scholastic language, God is the Primary Cause who works through secondary causes.

Secondly, God limits divine action to what is within the capacities of creatures. That is, God acts in accord with rational laws (which themselves are God's creation). Thus creatures are not only God's instruments but, in Luther's phrase, masks of God which hide God from scientific observation. Science does not study God but the tools God uses. This is the distinctively cruciform aspect of divine action because it means that God is willing to be considered unnecessary for our understanding of the world.

Finally, it is faith, our trust in the God revealed in Christ, that enables us to "see" God at work in the world. Our belief that God supplies our daily bread is something different from our knowledge of the processes that enable grain to grow, farmers to harvest it, and the economic system to put the bread in the store.

So now in order to talk about the big bang, evolution, or the early chapters of Genesis do we need to move from the subject of divine action to "creation"? Not exactly. We've *been* talking about creation. As Luther explains in the Small Catechism, belief that God is the creator means that God has made me and everything else. Then Luther lists all the things that God is doing now – preserving my life, providing food, etc. What God does in the world today is creation. God has always been active as the creator. What we want to do now is to move on to the special aspect of the doctrine of creation that deals with origins – of the universe and of living things.

Consider first the way in which science has moved. When I was in graduate school we talked about four basic interactions - gravitation, electromagnetism, and the weak and strong forces. (The weak force is responsible for beta decay and the strong force holds the nucleus together.) We now understand weak and electromagnetic forces as aspects of an "electroweak" interaction. There are theoretical attempts to combine this with the strong force to give a "grand unified theory" (GUT) and even to unite all four interactions in a "theory of everything"(TOE).

Combinations of these forces make the sun shine, keep our bodies functioning, make things fall to the ground, bring babies to birth, provide our food, and so on. We see them as instruments through which God brings all those things about. Then looking to the past, we can see those forces at work to form atoms, galaxies, stars, planets, and living things. And again, as Christians we can see those interactions as the means by which God has brought all those things into being. Cosmic and biological evolution can be understood theologically as applications of the doctrine of providence.

But we can't just leave it at that very general level and think that all problems have been solved. In the first place, there are a number of important things that we don't understand scientifically. For example, we are still a long way from knowing how the first living things developed from non-living molecules. There is no reason to despair of scientific solutions and appeal to miracles (i.e., unmediated divine action) to explain such things, but we should be honest about where we stand.

Secondly, some of the things that we do understand – in particular, natural selection as the primary mechanism for evolution – are inconsistent with popular ideas of God. I'll return to this point below.

Turning to details, we first need some appreciation of the scale of the universe. The stars in our own galaxy, the Milky Way, are spread out over distances on the order of a hundred thousand light years, while the large galaxy in Andromeda is about three million light years away. Galaxies are found out to distances of several billion light years. (That means that we are observing them as they were billions of years in the past.)

It was found that the light from other galaxies is shifted toward the red end of the spectrum, indicating that those clouds of stars are moving away from us. The big bang theory, the idea that this expansion began from an extremely hot, dense state, is now well established. There are three lines of evidence that support this theory.

First, Hubble announced in 1929 that there is a relation between the recessional speed of a galaxy and its distance from us. This can be modeled by a cloud of particles expanding outward from an initial explosion. Current estimates of the time since the beginning of the expansion give a value of about 14 billion years.

Then in 1965 microwave radiation from all over the sky was detected. This turns out to have the properties of radiation from a body at a temperature about three degrees above absolute zero. This microwave background is now understood to be a relic left over from the big bang. Its wavelength has increased roughly a thousand-fold (by the same process which produces the redshift in galactic light) since its last interaction with matter, at a time when the universe was less than half a million years old.

Finally, in the very hot conditions during the first seconds of the big bang, nuclear fusion reactions should have occurred which would have resulted in nuclei being about 75% hydrogen by mass and 25% helium. This agrees well with observations.

This sketch hardly does justice to the detailed evidence that has been found for the big bang. Up to date information can be found at <http://map.gsfc.nasa.gov/> But cosmologists aren't content to stop their explorations at this point. There have been many attempts to get closer to the "initial singularity" which represents the beginning of cosmic expansion according to general relativity. Inflationary cosmologies have had some success, and attempts to understand the origin of the cosmos in terms of string theory or other approaches to quantum gravity seem attractive to some cosmologists.

To the extent that such approaches are scientifically fruitful, we see that God is hidden even in the origin of the universe. God is willing to be upstaged by God's own creatures. The sign of the cross is placed on the cosmos from its inception.

But this isn't the end of the road. Ordinary matter makes up only a small fraction (about 4%) of the universe. The rest is "dark matter" and "dark energy" which we don't understand yet. Some theorists suggest that the properties of our universe can best be understood if it is only one member of an even vaster "multiverse." How would we deal theologically with the idea of multiple universes? Are there ways to correlate the current scientific prediction that the universe will continue to expand forever with Christian eschatology? There is still plenty of work to do, both for scientists and for theologians.

But now let's fast forward from the very early universe, through the formation of galaxies, stars, planets and (somehow!) life. As I noted earlier, we don't yet have a good explanation of how the first living systems came into being, but they did. And from that point on, life has developed by a process of evolution, "descent with modification." The distribution of fossils in geological strata, and the geographical distributions of fossils and living organisms, as well as the anatomical and biochemical relationships between different species, provide abundant support for the belief that evolution has been taking place over the past three and a half billion years.

But how does evolution work? Evolutionary theories had been proposed before the work of Darwin and Wallace, but it was with their suggestion that the process is driven by natural selection that the idea really took off. There will always be variations among members of a species, and some of those variations will be better suited for survival and production of offspring than will others *in a given environment*. This last qualification is crucial, for it means that natural selection does not have to do with some sort of absolute fitness for survival. If the environment changes, either through slow climate change or a sudden catastrophe like an asteroid impact, the characteristics that best suit an organism for survival will change. The environment acts as a filter to determine which properties are most likely to be passed on to the next generation.

That means that competition (for resources, breeding opportunities etc), privation, death and extinction play a major role in evolution. And that's one of the major theological concerns. How can we understand a loving and beneficent God using such an apparently harsh method in order to bring living things into being?

There's no easy way to "justify" God's use of natural selection and in fact trying to do so is presumptuous. (Cf. Romans 9:20.) But the theology of the cross gives a new way of thinking about the issue. We shouldn't picture God as ruthlessly forcing millions of generations through the evolutionary process without himself being affected by it, for in the Incarnation God becomes a participant in the evolutionary process. Jesus has the same evolutionary history and carries the same relationships with other species that we do. Moreover, he becomes a participant in evolutionary history on the side of the losers in the struggle for survival – because in the short term it's Pilate and Caiaphas who win.

And Easter means that there is hope for the losers: Those who humble themselves will be exalted. And that is hope not only for *Homo sapiens* but for the whole world, because again, in the Incarnation God has taken on organic relationships with all terrestrial life. Thus the idea of common descent gives us a way to think about how "all things" may be reconciled to God through the cross of Christ, as Colossians 1:20 says.

There continue to be criticisms of evolution, most of them motivated by religious concerns. Those in the Intelligent Design (ID) movement focus attention on claims for the "irreducible complexity" of biochemical structures and processes (Micheal Behe) and the difficult of explaining "complex specified information" in biological systems (William Dembski). We should put the best construction on such claims and take seriously the possibility that there are important features of living things that current evolutionary theories haven't yet explained. But it is not legitimate to make the jumps from "Science hasn't explained this" to "Science can't explain this" to "An Intelligent Designer (aka God) did this directly."

The ID movement is part of a larger campaign against "naturalism" and would serve little purpose in this campaign if it couldn't claim to show a need for God. Lawyer Philip Johnson, one of the chief

spokespersons for this campaign, has insisted that real faith in a creator God means believing that God has "left his fingerprints all over the evidence." This is a plausible demand – for a lawyer. A scientist will also expect observable evidence for theoretical claims. A theologian, however, will remember the words of Isaiah 45:15: "Truly, you are a God who hides himself, O God of Israel, the Savior."