

Lord of all creation

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Abstract

The popular view of evolution of life is the neo-Darwinist concept of natural selection. Most lay people think of evolution as a result of organisms adapting to random chance environmental changes. Modern discoveries emphasised modification of genetic processes by what is known as gene regulation, as major processes in evolution. This permits new developments in organic design, and these designs are sorted by natural selection. Palaeontology provides some evidence of the temporal changes from the early development of life with the simplest cells (prokaryotes) to new cells with complex reproduction (eukaryotes), through various genetic changes to the appearance of invertebrates and vertebrates, through fishes, amphibian, reptile and mammals to humans. For Christians this orderly progression in the midst of biological chaos, implies the handiwork of the Creator God from the beginning of Creation.

Key words

primitive life, timescale, gene- regulation, organic order

Introduction

Broadcast media and the popular press keep putting forward the concept that natural selection, in the Darwinian sense, is the basis for biological evolution. For example, David Attenborough's recent TV program on the rise of animals, seems to give the impression that if it would be an advantage for an organism to develop a structure, the structure suddenly appeared. Because the program is so short, there is no discussion of the mechanism for such changes. As I have found in discussions with lay people, this leads to a position where evolutionary change is said to take place purely by natural selection. For some people this leads to an anti-theological attitude. I would like to counter this.

In 2009 we celebrated 150 years since the publication of Darwin's book on the *Origin of Species*. It introduced a new method of thinking about the

great diversity of fossil and existing life around us. His contribution was that species could change slightly because of territorial migration or by ecological isolation. The concepts of genetic change were unknown to Darwin, and he could not explain the morphological changes he observed. It was Mendel's (1900) discovery of the genetic control that provided the missing link. These are the two historical points from which the study of the evolution of life must begin. The palaeontological, chemical and physical data from the early history of life must now be examined.

The earliest physical evidence of life

Stromatolites are sheet-like, conical or columnar growths of carbonate layers, and extant examples show that they occur in shallow water marine or lacustrine environments. The presence of stromatolites at Shark Bay shows that the carbonate layers grow by deposition from fibrils made by the simplest type (prokaryotic) cells. The discovery of stromatolites in rocks 3.45 billion years old at Pilbara, Western Australia, indicates the presence of biological activity at this stage of early history.

The discovery of stromatolites indicates the presence of living cells. By analogy with living stromatolites these were prokaryotic cells; that is cells without a nucleus such as cyanobacteria (blue green algae).

The next major phase in evolution was the development of eukaryotic cells. These cells had an isolated nucleus, and ribosomes, Golgi apparatus and mitochondria inside a strong cell wall. This new cell produced new methods of reproduction on which all subsequent evolution was based. Geochemical evidence is that they first appeared at 2.7 billion years ago. There is good evidence that they arose by symbiotic relationships among prokaryotic cells.

There is a long history following the evolution of eukaryotes during which no complex body fossils were formed. The first signs of these were flattened small groups, or bundles of 2mm wide aggregates laid out like strings of beads found in shallow water sediments. Such structures indicate a real development in organizational complexity, and occur wide spread across the world. In deep water deposits in China soon after, there are tubes 10-90 cm long, and without internal structures.

The Ediacara fauna

The last Precambrian unit, the Ediacaran Period, is known from about twenty localities around the world, and it lies stratigraphically below the Early Cambrian. At several localities the stratigraphic sequence can be observed on the ground, and the Ediacaran sediments pass up without a break into the Cambrian sediments.

The Ediacaran fauna is now well known. It contains organisms preserved in sediments laid in slightly different environments, and hence in slightly different ecological conditions. Possible sponges have been recorded from Oman and Australia as solid elements, and biochemically they have also been recognized. Most organisms were soft bodied, and they occur as impressions in the sediments. Despite this unpromising

preservation potential, fine details of structure can be readily observed. One abundant group (*Charnia*) consists of branching fronds attached at their base, and they were misidentified as related to modern corals. There are others, *Dickinsonia* and *Spriggina*, that are bilaterally symmetrical and seem to have segmented bodies. *Dickinsonia* can be up to one metre long, and enlarged images show that folds on the two sides do not meet medially. The genus *Yorgia* shows similar folds. Although a head like shape occurs in *Spriggina* and *Yorgia*, neither has eyes, an alimentary canal or appendages. Other genera are circular in outline, have divided edges, and their central areas have curved radial branches (*Tribrachidium*). In Namibia there are up to 30 well-preserved genera, including *Swartpuntia* with a vertical stature and radial folded branches; and *Pteridinium* with a folded stem from which hollow branches emerged.

Many unsuccessful attempts have been made to show that some of these organisms could have been the precursors of the Cambrian organisms. Some phosphatic materials from China have been interpreted as being dividing embryonic cell structures, but which other workers have interpreted as cell cysts.

The current view is that the Edicaran faunas indicate a burst of organised life that existed back to 580 million years, and then became extinct before the beginning of the Cambrian at 540 million years. Because of the wide range of morphologies, we conclude that a large number of genomes must have been present.

The Early Cambrian

1. New major Taxa

In this short period covering some 2million years, there appeared a vast range of organisms representing primitive chordates, (later to develop into vertebrates), and all the known phyla of invertebrates. Among the latter were good examples of arthropods, molluscs, echinoderms, brachiopods, cnidarians, and the peculiar Archaeocyathida. The greatest diversity is shown by the arthropods, and these are represented by the long ranging trilobites and the ostracods. The archaeocyatids became extinct in the Middle Cambrian.

Also in the Chengjiang in Yunnan, the Early Cambrian fauna is well preserved, and in it are many of the same types as occur in the Middle Cambrian Burgess Shale in Canada. These include many types of organisms that have left no traces in younger rocks. Some have general arthropod shape, several eyes on the head, appendages with breathing filaments but no walking branches, and a singly clawed anterior process. Others are arthropods with gill bearing appendages and no walking limbs anteriorly, and a long posterior portion without appendages (*Fuxianhuia*). Several other enigmatic genera also occur in these faunas.

Archaeocyathids are solitary organisms from small to 10cm in height, made of perforated calcium carbonate, with two concentric conical layers joined by septa. The larger individuals are joined together to form reefs, and smaller ones are isolated and inhabit deeper water. For such recently

formed design, their diversity is surprising, for twenty genera or more have been described.

This great change in organic morphological design must have taken place by modification of the genomes from the Ediacaran Period. And this process must have taken place on several occasions producing different results to account for the great diversity of the Cambrian faunas. These changes have never been repeated; for example, no new Phyla appeared after the Cambrian. These massive changes in the genomes result from gene regulatory processes. Gross changes in animal morphology took place without natural selection, but by modification of the genomes. The most striking of these changes took place with the Cambrian revolution.

What I see as a Christian is the removal of evolution from the randomness of natural selection dependent on changes in the environment, to an organised system within the genomes that had evolved as part of the Creator's plan.

2. Environmental changes

For these biotic developments to occur there must also have been some environmental changes that took place prior to the Cambrian that drove them. One example is the major temperature change with a glaciation that occurred at about 580 million years ago. Ice sheets spread to the equator, producing the 'Snowball Earth'. Naturally this produced changes in the chemistry of the oceans. Measurements show an increase in biologically fixed carbon at about this time, and this is related to a rise in the abundance of eukaryotic cells. This offers a part explanation of the development of the Ediacaran fauna at about this time.

But what were the environmental factors that occurred with the Cambrian explosion? The carbon isotope anomaly in marine sediments indicates the presence of biological activity under favourable conditions. But of greater significance was the development of a marine landscape change caused by the extinction of the Ediacaran fauna. This extinction is a critical factor. We know from Namibia that the extinction took place rapidly in geological terms. A major carbon isotope anomaly occurs in the Late Ediacaran Period indicating global changes in the environment, and this was related to the extinction of the Ediacaran fauna. This may have cleared the way for the rise of the Cambrian biota.

Subsequent events

After this Early Cambrian burst, no other phyla appeared in earth history: it seems that the changes that took place in the Early Cambrian set a stable pattern for the rest of evolution. But that does not mean that no further major changes took place because of genetic activity. Such changes took place by diversifying the patterns of the Early Cambrian phyla into classes and orders. As an example consider the trilobites. With minor modifications they flourished from the Early to Late Cambrian. Then in the Ordovician there were a number of major changes in their anatomy. These include when the Cryptolithids produced large head borders with punctae (pores) that may have housed sensors for detecting food; or the Raphiophorids with their large median head processes and enormous

genal spines, all characteristic of a planktonic existence; or the Siluro-Devonian Dalmanitids with schizochroal eyes, and heads and tails for locomotion.

In the Early Devonian there is a fine example of modifications within the group of fishes – the lungfishes. My own research has been involved with this group for several decades. Smaller in taxonomic scale than the Cambrian explosion these changes still required considerable genetic changes, implying unstable genetic structure compared with subsequent eras. The fossil record shows that lungfish arose from other sarcopterygians by the development of new structures such as the anterior rostrum, a new breathing system, a massive palate with joined pterygoids, the loss of the tooth bearing dentary and maxilla, and the development of crushing food on the palate. This also must have developed from a primitive sarcopterygian genotype by gene-regulation, as there is no evidence for any intermediate organisms.

Similar changes took place with the origin of amphibia some 350 million years ago. The massive extinction at the end of the Permian, allowed new ecological environments to be opened up, and into these new classes and orders, invertebrate and vertebrate life appeared.

The palaeontological record indicates that at certain periods there were sudden changes in morphological design, but there is no fossil record of the organisms involved in such changes. Molecular biologists have demonstrated that genomes are unstable structures, and gene regulation is a common phenomenon. Natural selection is still part of the evolutionary process, but it is not the driving cause of evolution. This is a matter that is studiously avoided by most popular scientific commentators. As one of my genetic colleagues comments, the origin of body plans is the essence of metazoan evolution, not the origin of species.

What mechanisms produce gene regulation?

There are several ways in which the genomes can be modified, and these produce modification of the protein end product. A summary of some of these is presented here. Modular groups of genes occur, and these act as a unit, but the modules may alter their position in the DNA sequence. Within the modular units, there may be multiplication or fusion of elements. And all these modular changes produce different protein outcomes. Or the non protein genes may become inverted or otherwise alter their position with respect to protein genes and may modify their production. Or protein genes may mutate and the sequence DNA to messenger RNA to proteins may be modified by mutation.

The spiritual dimension

How does biological evolution fit neatly into God's plan for the totality of Creation? This requires consideration of the whole of Creation as an entity from the development of the first chemical elements, to the formation of life, to the evolution of the means of modifying life, the methods of faunal extinction, and finally to the emergence of humans. Not only that, but the materially based human brain has the capacity to communicate with the

Creator by prayer and meditation, for individuals to love one another, to care for the totality of Creation, to appreciate and create beauty. In biblical terms humans have been made in the image of God.

How has this happened in the light of the background I have stated? This is a problem we as Christians must face. As part of the Creational plan, a means of making this transition must have been ordained. The nature of this process has still to be investigated. In scriptural terms it is portrayed as the tree of the knowledge of good and evil. In Genesis 3 the temptation is, if you eat of this tree you will be as God, knowing good and evil. But this is entirely a human experience.

Some authors never give thought to the pre-human history of the Earth as part of the Creation. But we as thoughtful Christians have to consider life from the earliest period of which we have knowledge to the present day. One organism depends on the consumption of another to sustain its life. The whole ecological system continues, and we as humans whether we eat flesh or vegetables, consume part of the creational system. Does this mean that in the eyes of the Creator, individual organic lives are not sacred in themselves, or that they are just items on the total plan to produce human beings? Or is there some point in the evolution of humans that we have overlooked? It is not only the spiritual aspects that concern us, but also the unique things that make us human – morality, capacity to investigate natural events, capacity to appreciate beauty and music. In some sense all these phenomena relate back to spiritual awareness, part of the concept that we are made in the image of God, or thankfulness to our Creator in prayer, inspiration, and enlightenment.

Some theological aspects should be considered here. God is beyond space and time, yet He is not separated from His Creation. In the coming of Christ as a human being, God puts his stamp on Creation as it is. Christ's teaching and His sacrifice for us as sinful creatures, puts one aspect of His coming to the fore, but it also involves Him as part of the Creation. What a commitment has been assigned to us as Christians, to approach the Creator with due reverence before the throne of grace, but also to take care of that part of the Creation for which Christ has made us responsible.