THE ORIGIN AND DIVERSIFICATION OF LIFE

By Ashby L. Camp

I. Origin of Life[1]

A. The Complexity

1. On top of the extreme improbability of planet Earth arising from the Big Bang, the creation story of modern western culture adds the extreme improbability of a living cell spontaneously arising on Earth. To appreciate this, you need to have some sense of the insane, integrated complexity of a living cell.

a. Each cell is an amazing world unto itself: it can take in nutrients, convert these nutrients into energy, carry out specialized functions, and reproduce as necessary. Even more amazing is that each cell stores its own set of instructions for carrying out each of these activities.

b. A cell is not a tiny bag of goo; it's more like a miniature computer that's executing a "life" program.

2. The living world contains two fundamentally different types of cells: prokaryotes and eukaryotes. Prokaryotes, of which common bacteria are the prime example, are simpler in that they do not have a nucleus or other organelles, but they are far from simple. James A. Shapiro, a Cambridge educated professor of biochemistry and molecular biology at the University of Chicago, wrote in "Bacteria as Multicellular Organisms," *Scientific American*, Vol. 258, No. 6 (June 1988), p. 82:

> Although bacteria are tiny, they display biochemical, structural and behavioral complexities that outstrip scientific description. In keeping with the current microelectronics revolution, it may make more sense to equate their size with sophistication rather than with simplicity.

3. Here's a diagram of a prokaryote showing its major features. Prokaryotic cells have three architectural regions: **appendages** called flagella and pili—proteins attached to the cell surface; a **cell envelope** consisting of a capsule, a cell wall, and a plasma membrane; and a **cytoplasmic region** that contains the cell genome (DNA), ribosomes, and various sorts of inclusions.

a. The capsule is a barrier that serves to protect a bacterium, allow adherence to surfaces, prevent drying out, and may provide nutrients.

[1] These are notes from a class I taught at church in 2005.

b. The cell wall maintains the bacterium's overall shape. The cell wall also is vital for containing the expansion of the cell membrane caused by the influx of water due to the higher concentration of water in the environment than in the cytoplasm. The creates counter pressure that prevents more water from entering.

c. The cell membrane, usually called a plasma membrane in eukaryotic cells, serves to separate and protect a cell from its surrounding environment and is made mostly from a double layer of proteins and lipids, fat-like molecules. Embedded within this membrane are a variety of other molecules that act as channels and pumps, moving different, select molecules into and out of the cell.

d. The cytoplasm is the fluid component inside the cell membrane. In addition to containing DNA, ribosomes, and other inclusions, it contains many salts and is an excellent conductor of electricity, creating the perfect environment for the mechanics of the cell.

e. Ribosomes are complexes composed of many molecules, including RNAs and proteins, and are responsible for processing the genetic instructions carried by mRNA. It translates an mRNA's genetic code, which it copied from the DNA and delivered to the ribosome, into the exact sequence of amino acids that make up the specified protein.

f. DNA is an amazingly complicated molecule that contains the instructions for manufacturing the multitude of proteins necessary for cellular life. (A "gene" is a set of instructions for manufacturing protein[s] or chemically useful products.) In a spectacular process, molecular machines unwind the double-stranded DNA at a certain point, open the section containing the instructions for building the needed protein, and copy those instructions by constructing a corresponding ribbon of mRNA. When the necessary information has been copied in the form of mRNA, the mRNA is shepherded to a ribosome, which then fabricates the protein based on the code copied onto the mRNA. The protein is then taken to where it's needed and used for the purpose for which it was fabricated.

g. The bacteria *Mycoplasma genitalium* have the fewest genes known to exist in any living thing – 517. Based on studies on these bacteria, researchers estimate that the minimum number of genes for the simplest imaginable bacterium is between 265 and 350. However, Mycoplasmas are parasites that require a host to meet some of their metabolic requirements, so the real number is no doubt even higher. Free living bacteria seem to require a minimum of 1500 to 1900 genes.

h. Bacteria reproduce by what's called binary fission. Through the coordinated effort of various molecular machines, an exact copy of the DNA is made and attaches to the cell membrane. The cell elongates to approximately double its original size, and then the cell membrane pinches in and forms two cells from the one, each with its own compliment of DNA and all else that it needs for life.

i. The energy for this and other cellular work is supplied by a nanomachine called ATP (adenosine triphosphate) that converts the energy in nutrients (low-energy covalent bonds) into a form more useful for the work done in cells.

(1) As creationist biologist Jerry Bergman states:

> Without ATP, life as we understand it could not exist. It is a perfectly-designed, intricate molecule that serves a critical role in providing the proper size energy packet for scores of thousands of classes of reactions that occur in all forms of life. Even viruses rely on an ATP molecule identical to that used in humans. The ATP energy system is quick, highly efficient, produces a rapid turnover of ATP, and can rapidly respond to energy demand changes (Goodsell, 1996, p.79).
>
> Furthermore, the ATP molecule is so enormously intricate that we are just now beginning to understand how it works. Each ATP molecule is over 500 atomic mass units (500 u). In manufacturing terms, the ATP molecule is a machine with a level of organization on the order of a research microscope or a standard television (Darnell, Lodish, and Baltimore, 1996).

(2) Here is a diagram of the ATP nanomachine. In 1997 Paul Boyer, John Walker, and Jens Skou received the Nobel Prize in Chemistry for elucidating the synthesis of ATP. The press release from the Royal Swedish Academy of Sciences that accompanied the granting of that prize includes:

> ATP functions as a carrier of energy in all living organisms from bacteria and fungi to plants and animals including humans. ATP captures the chemical energy released by the combustion of nutrients and transfers it to reactions that require energy, e.g. the building up of cell components, muscle contraction, transmission of nerve messages and many other functions. ATP has been termed the cell's energy currency.

4. We've only touched the hem of the garment, but I hope that gives you some idea of the magnitude of the problem facing someone who claims that the first living cell arose spontaneously from chemicals on earth.

B. The Story

1. According to modern western culture, after planet earth fortunately arose from the residue of generations of exploded stars, lightning, ultraviolet rays from the sun, or heat from volcanoes affected gases in the primitive earth's atmosphere and somehow changed them into complicated organic compounds. These organic compounds somehow accumulated in the ocean and then somehow linked up to form even more complex molecules. Eventually, one of these molecules began to replicate which through countless copying errors produced a variety of similar types of molecules, all of which at

some point happily came together inside a membrane and began functioning as the unbelievably complex living cell.

2. Just so you'll know I'm not kidding, here's how it was put in an Emmy winning PBS NOVA film titled "The Miracle of Life" (quoted in Hanegraaff, 1998, p. 70):

> Four and a half billion years ago the young planet Earth . . . was almost completely engulfed by the shallow primordial seas. Powerful winds gathered *random molecules* from the atmosphere. Some were deposited in the seas. Tides and currents swept the *molecules* together. And somewhere in this ancient ocean the miracle of life began... *The first organized form of primitive life was a tiny protozoan [a one-celled animal]*. Millions of protozoa populated the ancient seas. These early organisms were completely self-sufficient in their sea-water world. *They moved about their aquatic environment feeding on bacteria and other organisms*. . . . From these one-celled organisms evolved all life on earth.

C. The Reality

1. Klaus Dose, Director of the Institute for Biochemistry at the Johannes Gutenberg University in Mainz, Germany candidly admitted in 1988 in *Interdisciplinary Science Reviews*: "More than 30 years of experimentation on the origin of life in the fields of chemical and molecular evolution have led to a better perception of the immensity of the problem of the origin of life on Earth rather than to its solution. At present, all discussions on principal theories and experiments in the field either end in a stalemate or in a confession of ignorance."

2. In 1992, Dr. Werner Arber, Professor of Microbiology at the University of Basel and recipient of the Nobel Prize in Physiology/Medicine in 1978, stated:

> Although a biologist, I must confess that I do not understand how life came about. . . . I consider that life only starts at the level of a functional cell. The most primitive cell may require at least several hundred different specific biological macro-molecules. How such already quite complex structures may have come together, remains a mystery to me. The possibility of the existence of a Creator, of God, represents to me a satisfactory solution to this problem.

3. The March 3, 1998 issue of *Trends in Ecology and Evolution* contained a report on a NASA-sponsored workshop called "Evolution: A Molecular Point of View." Many of the big names in origins research were present and a lot of interesting points of view were discussed. The author of the article noted:

> "Sherwood Chang opened the program with the cautious reminder that any canonical scenario for the stepwise progression toward the origin of life is

still a 'convenient fiction.' That is, we have almost no data to support the historical transitions from chemical evolution to prebiotic monomers, polymers, replicating enzymes, and finally cells."

4. On May 3, 2004, Andy Knoll, a professor of biology at Harvard and author of *Life on a Young Planet: The First Three Billion Years of Life*, was interviewed as part of a PBS NOVA program. He is described as a person who has "exhaustively investigated" the origin of life. Here are excerpts from an interview:

NOVA: In a nutshell, what is the process? How does life form?

Knoll: The short answer is we don't really know how life originated on this planet. There have been a variety of experiments that tell us some possible roads, but we remain in substantial ignorance.

NOVA: So at this point we're seeing the origins of life through a glass darkly?

Knoll: If we try to summarize by just saying what, at the end of the day, do we know about the deep history of life on Earth, about its origin, about its formative stages that gave rise to the biology we see around us today, I think we have to admit that we're looking through a glass darkly here. . . .

. . . We don't know how life started on this planet. We don't know exactly when it started, we don't know under what circumstances.

It's a mystery that we're going to chip at from several different directions. . . .

NOVA: Will we ever solve the problem?

Knoll: I don't know. I imagine my grandchildren will still be sitting around saying that it's a great mystery, but that they will understand that mystery at a level that would be incomprehensible to us today.

5. July 1, 2005 issue of *Science* included in its top 25 questions facing science "How and where did life on earth arise?"

6. The article "Jump-Starting a Cellular World: Investigating the Origin of Life, from Soup to Networks" in the November 15, 2005 issue of *PLOS* (Public Library of Science) included:

"But beyond assuming the first cell must have somehow come into existence, how do biologists explain its emergence from the prebiotic world four billion years ago?

"The short answer is that they can't, yet."

II. Diversification of Life

A. On this luckiest of all planets, it just so happened that lightning or energy from sunshine or volcanoes transformed some gases in the atmosphere into complex organic compounds. These organic compounds somehow accumulated in the ocean and then somehow linked up to form even more complex molecules. Eventually, one of these molecules began to replicate which, through countless copying errors, resulted in a variety of similar types of molecules, all of which at some point happily came together inside a membrane and began functioning as the unbelievably integrated and complex living cell.

B. I find that story absurd, but that is what the intelligentsia takes as fact. As the story continues, this living cell, this product of astronomical improbabilities, not only survived but went on to become the ancestor of all things that have ever lived on this planet. This supposedly happened through the wonder of evolution.

C. The Theory Summarized

1. The essence of the goo-to-you evolution story is that this first living cell generated a population of cells through the skill of reproduction that it somehow possessed when it came together by chance. As these cells continued multiplying, errors occurred that caused some descendants to have a slightly different form than their parents.

2. On rare occasion, one of the mutant forms happens to be better suited than its ancestral form to survive in its environment. It's important to note that, according to the theory, the modifications are not in response to the environment. They simply are blind, random changes that sometimes luckily confer a survival advantage. Because some mutant organisms have a higher likelihood of survival, they are more likely to leave more offspring, so over time, they displace the original population, meaning the original form evolves to the enhanced form. It is believed that the accumulation of a countless number of such slight, random changes over billions of years produced the wide variety of life on our planet today.

3. No one disputes that random mutation and natural selection can generate variations in living things. The question is whether that blind mechanism is sufficient to generate from a single cell jellyfish, lobsters, banana trees, and whales. In other words, is it reasonable to believe that blind shots in the dark can produce the amazing integrated complexity that abounds in the biosphere? This theory is said to be as certain as the law of gravity, but that's a joke.

D. Some General Problems with the Claim of Certainty

1. No one knows anything about the first cell that allegedly gave rise to all of earth's life forms. So people are free to assign to it, within very broad limits, whatever qualities they think are necessary for it to fill the role of mother of all living things.

a. For example, Robert Shapiro, an origin of life researcher, speculates that the first cell was a protein-based life form that lacked DNA and RNA (Shapiro, 293-295.) Another origin of life researcher, A. G. Cairns-Smith, states: "Evolution did not start with the organic molecules that have now become universal to life: indeed I doubt whether the first organisms, even the first evolved organisms, had any organic molecules in them at all." (Cairns-Smith, 107.)

b. Without knowing the characteristics and qualities of the first cell, any claim that it had the capacity to become the mother of all living things necessarily is speculation. That's fine, but with speculation as a footing the claims of certainty made for the general theory of evolution are out of order.

2. The phenotypes (the actual forms) in the hypothesized chains of descent are unknown. Even where fossils are offered in support of an alleged lineage, one is given a sequence (usually based on scraps) of admittedly *nonlineal* organisms that have one or more *features* that allegedly correspond to features of organisms in the hypothesized lineage. The phenotypes in the alleged lineages are constructs rather than data. As D. M. Irwin stated in *Nature* **403**:480, 2000:

> Remember that although a living individual must have had ancestors, fossils are unlikely to represent any of them. Even if a fossil was an ancestor, we will never know this—we can never know with certainty what happened in the past. Accepting that fossils are not ancestors also means that there are no “missing links” in the fossil record because fossils cannot be ordered, as traditionally depicted, into an evolutionary lineage. There is no ladder of life. Most, if not all, fossils lie on the dead branches of the tree of life, and we must remember that most of our tree of life is dead, with only a few green living leaves at the tips of the branches.

3. Even if there were specific phenotypes in the hypothesized lineages, we do not know what heritable instructions or phenomena would cause those phenotypes. We don't even know the relationship between phenotype and heritable causes of those phenotypes in modern organisms! So we cannot know whether those phenotypes reasonably can be explained by known mechanisms of alteration.

4. We do not know the selective states or pressures that existed during the hypothesized eons of transformation, so we cannot know whether those changing states or pressures could sculpt the (unknown) heritable instructions or phenomena so as to generate the multitude of life forms that have inhabited the earth. What little we think we know about the environments of fossil creatures is based debatable interpretations of

sparse data, but even if we had exact environmental information, we couldn't deduce selection pressures (we can't do that in the modern world).

E. Some Specific Weaknesses of the Claim

1. Experimental data – Experiments indicate there are natural limits to the extent to which a species can be changed by the accumulation of genetic mutations.

a. As science commentator Jeremy Rifkin (and many others) has noted:

> The fruit fly has long been the favorite object of mutation experiments because of its fast gestation (twelve days). X rays have been used to increase the mutation rate in the fruit fly by 15,000 percent. All in all, scientists have been able to "catalyze the fruit fly evolutionary process such that what has been seen to occur in *Drosophila* (fruit fly) is the equivalent of many millions of years of normal mutations and evolution." Even with this tremendous speedup of mutations, scientists have never been able to come up with anything other than a fruit fly. More important, what all these experiments demonstrate is that the fruit fly can vary within certain upper and lower limits but will never go beyond them. (Rifkin, 134.)

b. The same holds true for the extensive genetic experiments done on *E. coli* bacteria. According to geneticists Lane Lester and Ray Bohlin:

> The study of bacteria has been profoundly at the center of studies of mutations. This is because they reproduce rapidly, producing large populations and large numbers of mutants. They are also easily maintained and their environments are easily manipulated in the laboratory. Despite all their advantages, never has there arisen in a colony of bacteria a bacterium with a primitive nucleus. Never has a bacterium in a colony of bacteria been observed to make a simple multicellular formation. Although hundreds of strains and varieties of *Escherichia coli* have been formed, it is still *Escherichia coli* and easily identifiable as such. (Lester and Bohlin, 88.)

2. Genetic improbability – The claim that the genetic program for building the first cell was transformed into a program for building humans and every other life form by the gradual accumulation of blind errors in the genetic program is extremely improbable.

a. As William Fix wrote in 1984 in his book *The Bone Peddlers*:

> Whether one looks to mutations or gene flow for the source of the variations needed to fuel evolution, there is an enormous probability

> problem at the core of Darwinist and neo-Darwinist theory, which has been cited by hundreds of scientists and professionals. Engineers, physicists, astronomers, and biologists who have looked without prejudice at the notion of such variations producing ever more complex organisms have come to the same conclusion: The evolutionists are assuming the impossible.

b. Renowned French zoologist Pierre-Paul Grasse put his skepticism more colorfully:

> What gambler would be crazy enough to play roulette with random evolution? The probability of dust carried by the wind reproducing Durer's "Melancholia" is less infinitesimal than the probability of copy errors in the DNA molecule leading to the formation of the eye; besides, these errors had no relationship whatsoever with the function that the eye would have to perform or was starting to perform. There is no law against daydreaming, but science must not indulge in it. (Grasse, 104.)

c. Mathematicians/astronomers Sir Fred Hoyle and Chandra Wickramasinghe concur. Summarizing his and Hoyle's analysis of the alleged mechanism of evolution, Wickramasinghe states:

> We found that there's just no way it could happen. If you start with a simple micro-organism, no matter how it arose on earth, primordial soup or otherwise, then if you just have that single organizational, informational unit and you said that you copied this sequentially time and again, the question is does that accumulate enough copying errors, enough mistakes in copying, and do these accumulations of copying errors lead to the diversity of living forms that one sees on earth. That's the general, usual formulation of the theory of evolution. . . . We looked at this quite systematically, quite carefully, in numerical terms. Checking all the numbers, rates of mutation and so on, we decided that there is no way in which that could even marginally approach the truth. (Varghese, 28.)

3. Irreducibly complex structures – There are complex structures and systems that must have all the parts present and working for the function of that structure or system to be fulfilled. It's an all or nothing thing, a chasm that cannot be spanned incrementally.

a. A classic case is the bacterial flagellum, an outboard motor that spins the flagellum up to 100,000 rpm.

b. The intricate machinery of this molecular motor requires approximately forty proteins. Yet the absence of any one of these proteins results in the complete loss of motor function. As Robert Macnab wrote in *CRC Critical Reviews in Biochemistry*, Vol. 5, Dec. 1978, p.291-341:

> one can only marvel at the intricacy, in a simple bacterium, of the total motor and sensory system which has been the subject of this review and remark that our concept of evolution by selective advantage must surely be an oversimplification. What advantage could derive, for example, from a 'preflagellum' (meaning a subset of its components), and yet what is the probability of 'simultaneous' development of the organelle at a level where it becomes advantageous?

c. The Darwinists claim that that the parts of the system evolved step by step for other purposes and then were then recruited wholesale to function as a flagellum, but there are huge problems with that.

(1) Scott Minnich, Professor of Biology at the University of Idaho, and an expert on the flagellum, says in response to the co-option hypothesis:

> With a bacterial flagellum, you're talking about a machine that's got forty structural parts. Yes, we find ten of them are involved in another molecular machine, but the other thirty are unique. So where are you going to borrow them from? Eventually you're going to have to account for the function of every single part as if originally having some other purpose. I mean you can only follow the argument so far, until you run into the problem that you're borrowing from nothing. . .'

(2) Regarding the proposed construction of the flagellum by co-option, John Bracht writes:

> The problem is that the proteins which are to become the flagellum are coming from systems that are distinctly non-flagellar in nature . . . and being co-modified from their original molecular interactions into an entirely new set of molecular interactions. Old interfaces and binding sites must be removed and new ones must be created. But given the sheer number of flagellar proteins that must co-evolve . . . the Darwinian explanation is [very unlikely and therefore] really no different from appealing to a miracle.

4. Fossil Record

a. Cambrian Explosion

(1) At essentially the same time (according to conventional dating), a wide variety of animal phyla appear in the fossil record. Representatives of nineteen of the forty known animal phyla definitely make their first appearance in the fossil record during the Cambrian explosion. Three phyla appear in the Precambrian. Six animal phyla first appear in the fossil record after the Cambrian period, and twelve more are not represented in the fossil record. It is believed, however, that most, if not all, of

these phyla were present by the Cambrian (based on presumed evolutionary relationships), and many paleontologists think they may have originated during the Cambrian explosion.

(2) Phyla are a broad, basic category of plant and animal life based on large differences in form or structure, especially basic body plans. Familiar examples of basic animal body plans are cnidarians (corals and jellyfish), mollusks (squids and shellfish), arthropods (crustaceans, insects, and trilobites), echinoderms (sea star and sea urchins), and the chordates, the phylum to which all vertebrates including humans belong.

(3) Since phyla are among the most basic categories of animal life, their appearance would have been preceded by massive amounts of evolutionary diversification, yet there are no fossils documenting this activity.

b. Systematic gaps

(1) There should be literally millions of chains of descent, and yet when it comes to documenting evolution, we're left to argue over a handful of disputed claims involving chains of vertebrates (e.g., reptiles to mammals, whales).

(2) This is especially significant in light of the fact vertebrates make up only a tiny fraction of fossils. Here's a chart showing the percentages. Why is the claim made where the fossil resolution is poorest?

> As it turns out, 95% of all fossils are shallow marine invertebrates, mostly shellfish. The fossil record documents primarily marine organisms buried in marine sediments, which were catastrophically deposited.
>
> Of the 5% remaining fossils, 95% of them are algae and plant fossils (4.75% of the total). In that left over 5% of the 5%, insects and all other invertebrates make up 95% (0.2375 % of the total).
>
> All of the vertebrate fossils considered together, (fish, amphibians, reptiles, birds, and mammals), comprise only 0.0125% of the entire fossil record, and only 1% of these, or .000125% of the total, consist of more than a single bone! Almost all of them come from the Ice Age. Surely, the vertebrate fossil record is far from complete.