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ABSTRACT

This critique of origin of life theories is limited to a consideration of the hypothetical primordial atmosphere, the formation of relatively simple organic compounds and the formation of complex macromolecules. It is maintained that the earth has always had an atmosphere similar to its present day atmosphere and that this and other proven thermodynamic and chemical kinetic principles and probability considerations positively exclude a naturalistic evolutionary origin of life.

INTRODUCTION

A crisis has been reached in theoretical and laboratory work related to theories on the origin of life. Success in laboratory experiments intended to point the way to possible pathways that brought about the chemical evolution of life on earth has been trivial. Most of the critically important areas that present the greatest obstacles to plausible theories have failed to yield to the concerted efforts of workers in the field. John Keosian, one of the more prominent early workers, in a most discouraging assessment of the progress that has been made, states "All present approaches to a solution of the problem of the origin of life are either irrelevant or lead into a blind alley. Therein lies the crisis"(1). A friend of mine, a Ph.D. scientist, who came to this country intending to get his Ph.D. under one of the most prominent workers in the origin of life field, abandoned his work with this scientist after two years in disillusionment and switched to a major in synthetic organic chemistry. He reports that today, in contrast to earlier years, fewer students are entering this field.

Anyone attempting to devise a plausible explanation for a naturalistic, mechanistic evolutionary origin of life must attempt to bridge a chasm that is so immense as to suggest to many scientists, after a careful study of the problem, that it is unbridgeable. While perhaps still clinging to faith in a naturalistic explanation, Green and Goldberger have candidly stated that ". . .the macromolecule-to-cell transition is a jump of fantastic dimensions, which lies beyond the range of testable hypothesis. In this area all is conjecture. The available facts do not provide a basis for postulating that cells arose on this planet"(2). Incidentally, it should be immediately obvious that any theory that lies beyond the range of testable hypothesis cannot be a scientific theory. Origin of life theories are not scientific theories but are merely highly speculative attempts to devise imaginary pathways to life. Any truly comprehensive origin of life theory will forever remain untested and untestable, and thus outside the realm of empirical science.

The origin of life would require the formation in huge quantities of hundreds, and most likely, thousands of different kinds of large and complex protein, DNA and RNA molecules, as well as a variety of other molecules. With respect to this point Van Rensselaer Potter states "It is possible to hazard a guess that the number is not less than 1,000, but whether it is 3,000 or 10,000 or greater is anyone's guess"(3). In addition, the origin of life would require many complex and dynamically functional structures, such as membranes, ribosomes, energy-producing complexes, and synthesizing apparatuses, all of which must be precisely coordinated in time and space so as to produce a totally self-sufficient, self-replicating entity. It will be documented that the restraints imposed by natural laws and processes now operating in the universe provide insuperable barriers to a mechanistic evolutionary origin of life and require the only possible alternative explanation, a supernatural creation of life.

In this paper, discussion will be limited to a consideration of the hypothetical primordial atmosphere, the thermodynamics involved in the formation of relatively simple organic compounds, such as amino acids, sugars, purines and pyrimidines, and thermodynamic and probability considerations involved in the origin of complex molecules and metabolic systems.

THE HYPOTHETICAL PRIMORDIAL ATMOSPHERE

Workers in the origin of life field early realized that life could not have evolved in an atmosphere similar to the present atmosphere. The atmosphere today contains 78% mitrogen, 21% oxygen, and 1% argon, carbon dioxide, carbon monoxide, water vapor and other gasses. It is thus highly oxidizing. Life could not evolve in an atmosphere containing a significant quantity of free oxygen, since substances necessary for the origin of life, such as amino acids, sugars, etc., would be rapidly oxidized to water, carbon dioxide, nitrogen, sulfates and other oxidized substances. It was thus assumed by early workers, such as Oparin, that the early earth atmosphere was reducing, containing in addition to water vapor, nitrogen and carbon dioxide, significant quantities of carbon monoxide, methane (CH_4), ammonia (NH_3) and hydrogen (4). It was assumed that no free oxygen existed on the earth at that time. Most origin of life experimental work has employed mixtures of methane, ammonia, hydrogen and water vapor or other reducing mixtures.

As far back as 1966, however, Phillip Abelson, a geochemist and president of the Carnegie Institution of Washington, D.C., stated that there was not only no evidence that the earth ever contained a methane-ammonia atmosphere but there was much evidence against it (5). At about the same time, C.F. Davidson, a uniformitarian geologist, was presenting evidence that the earth had never possessed an atmosphere different from that of today (6). A few years later Brinkman argued that photolysis of water in the atmosphere would have produced as much as 25% of the present atmospheric oxygen very early in the earth's history, long before life is supposed to have evolved (7).

Dimroth and Kimberly realized that the distribution of minerals of carbon, sulfur, uranium and iron is dependent on the atmospheric content of oxygen. They then reasoned that a comparison of the distribution of these minerals in rocks of assumed ancient ages to those in rocks of very recent ages would reveal whether or not the atmospheric content of oxygen was different in the past. These studies established that the distribution of those four minerals in the oldest sedimentary rocks was no different from that found in young rocks. They state "In general, we find no evidence in the sedimentary distributions of carbon, sulfur, uranium, or iron, that an oxygen-free atmosphere has existed at any time during the span of geological history recorded in well-preserved sedimentary rocks"(8). Walton (9) and Austin (10) have presented powerful geochemical evidences for an oxygen-rich atmosphere very early in earth history. Austin states "The many mineral forms of ferrous and ferric iron in Archaean and lower Proterozoic rocks are most suggestive of oxygen-rich conditions. Sulfate in the oldest rocks indicates oxygen in the water. Weathered crusts on ancient rocks appear to require oxygen in both air and water."

Today hardly any knowledgeable evolutionists are arguing that the earth ever had a methane-ammonia-hydrogen atmosphere. The consensus appears to be growing that, at the very least, the earth had an oxidized atmosphere consisting chiefly of water vapor, nitrogen, and carbon dioxide. No evolutionist who believes that life evolved on this planet can concede, however, that the atmosphere of the early earth was rich in oxygen, for such a condition would render the evolution of life totally impossible. Nevertheless, more and more empirical evidence is accumulating that indicates that the earth from its earliest times had an oxygen-rich atmosphere similar to present times. If true, then an evolutionary origin of life would have been absolutely impossible and would render moot any further discussion of origin of life theories.

THE ORIGIN OF RELATIVELY SIMPLE ORGANIC COMPOUNDS

For the sake of further discussion, the conclusions reached in the above section will be ignored and it will be assumed that the hypothetical early earth had a reducing atmosphere of some sort. Would it be possible, under these or other assumed conditions, to generate significant quantities of such monomers as amino acids, sugars, purines and pyrimidines required for the origin of proteins, DNA and RNA, as well as the origin of other organic compounds required for the origin of life? Evolutionists have a blind faith that this must have been possible, but there is powerful evidence against it. Evolutionists believe that the oceans were generated very early in the earth's history. Presently the earth's surface supports more than 350 million cubic miles of water. Any substance produced on the earth would eventually be dissolved in and diluted by this huge quantity of water. Therefore, any substance required for the origin of life, whether a simple compound such as ammonia, or a very large and complex molecule, such as a particular RNA molecule, would have to be produced in an enormous quantity--many trillions of tons. That consideration alone immediately rules out the production of nitrogen-containing compounds in significant quantity. If all the nitrogen in the atmosphere were converted into a single nitrogen-containing compound, such as ammonia, and this substance was dissolved in the present oceans, the concentration would be about 0.2 molar. However, it would be generous to assume that even 0.1% of the nitrogen were in the form of nitrogen-containing compounds. Assuming this conversion rate reduces the concentration to 0.0002 molar. According to evolutionary scenarios, however, the nitrogen would be distributed among many nitrogen-containing compounds. Assuming the nitrogen to be distributed evenly among 100 compounds further reduces the concentration to 0.000002 molar or 2×10^{-6} molar. Thus, even assuming a process efficient enough to convert 100% of the nitrogen available in the ocean into nitrogen-containing compounds, the concentration of any one compound would be vastly less than that used in most origin of life experiments, where the concentration used is typically 0.1 molar and greater.

Regardless of the above considerations, enormously efficient synthetic processes would have to operate to produce the trillions of tons of each compound required. It can easily be shown, however, that all processes that could possibly have operated on the hypothetical primitive earth in the formation of even relatively simple substances would have been enormously inefficient. Origin of life scenarios assume that the early earth had an atmosphere of simple gases, such as methane, ammonia, water vapor, hydrogen, and other gases. Almost all of the energy available would have been that produced by the sun. Minor amounts would have been available from electrical discharges and very small amounts of energy would have been available from heat, radioactive decay and other sources. Based on proven principles of science it can be shown that the rates of destruction of such substances as amino acids, sugars, purines and pyrimidines vastly exceed their rates of formation. It would thus be impossible under any plausible primitive earth conditions to produce a significant quantity of these simple substances, let alone the large and complex macromolecules, such as proteins and nucleic acids.

These facts were pointed out over 25 years ago in an article published in Nature by D. E. Hull (11). Glycine, a two-carbon compound, is the simplest amino acid. Of all amino acids, it is the easiest to form and the hardest to destroy. Yet its rate of destruction would be about one million times greater than its rate of formation. Hull points out that 97% of any glycine formed in the atmosphere would be destroyed before it reached the ocean. The ocean provides no safe haven, for there various degradative processes lead to a relatively rapid decomposition. Hull calculates that the concentration of glycine under plausible primitive earth conditions would be about 10^{-20} molar. On the other hand, glucose, although a relatively simple substance, contains six carbons compared to the two found in glycine. Compared to glycine its formation is much more inefficient and its rate of destruction is much higher. Hull calculates that the concentration of glucose under primitive earth conditions would be about 10^{-134} molar. This means that if the reaction volume was equal to the volume of the entire known universe, the probability of finding a single molecule of glucose would be vanishingly small. These and others considerations led Hull to state that "The physical chemist, guided by the proved principles of chemical thermodynamics and kinetics, cannot offer any encouragement to the biochemist, who needs an ocean full of organic compounds to form even lifeless coacervates."

The proven principle is very simple and absolutely compelling: rates of destruction of all substances under any conceivable plausible primitive earth conditions vastly exceed their rates of formation. It is thus impossible for any of these compounds to have been produced in significant quantities.

Stanley Miller, in his classic experiment published in 1953 (12) and which gave great encouragement to origin of life theorists, circumvented the above difficulty by providing a trap in his apparatus (Figure 1).

Miller circulated methane, ammonia, hydrogen and water vapor through his apparatus, which was equipped with an electrical discharge chamber (simulating lightning) to provide a high-energy source. Minute quantities of products were formed during each discharge and the products produced were immediately isolated in the trap. The starting materials, or gases, were repeatedly exposed to the energy source but all solid products were immediately isolated in the trap, where they were no longer exposed to the energy source. Thus, the quantities of products in the trap gradually accumulated, while the gases continuously circulated. After about a week Miller analyzed the aqueous solution in the trap. He found that it contained a few amino acids, chiefly glycine and alanine, and a few simple acids. Almost the entire scientific world hailed Miller's experiment as establishing a sound empirical basis for a naturalistic origin of life.

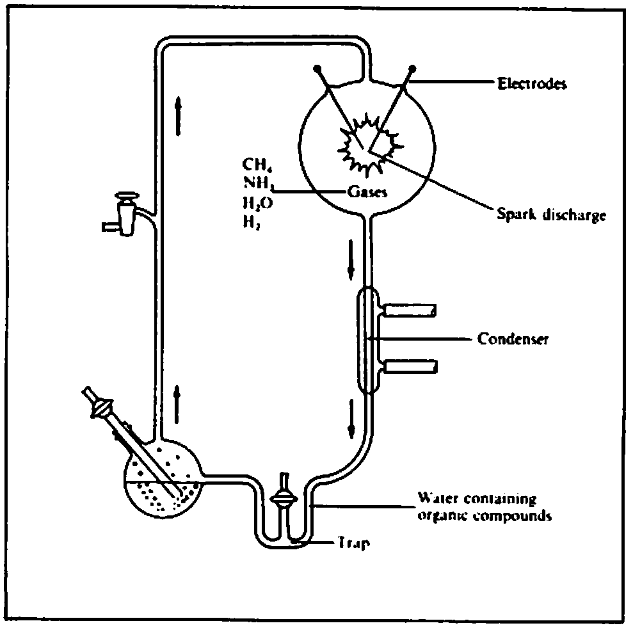

Figure 1. The Miller "origin of life" apparatus

Such claims must be rejected because (1) the results were extremely trivial since only a few amino acids, building blocks of proteins, were produced (2), no trap would have been available on the primitive earth--as pointed out earlier the ocean could not act as a trap (3), even if a trap were available, the trap itself would be fatal to origin of life theories. If products are isolated in a trap to remove them from the energy source in order to prevent their destruction, the origin of life process would therewith be brought to a halt. Each step in the origin of life would be an uphill process requiring an input of energy. Thus, to form the chemical bonds between amino acids to build them up into proteins requires a large quantity of energy. If the amino acids are isolated in a trap, obviously no energy is available to effect the next step, their combination into proteins. If energy available in any form on the primitive earth were re-introduced, the amino acids would be destroyed at rates that would vastly exceed the rate at which they would combine to form proteins. The origin of life chemist is thus caught in a trap--with energy, he's dead, but without energy, he's dead.

Another insuperable barrier to the production of amino acids and sugars in significant quantities is the fact that amino acids and sugars react with one another to their mutual destruction (5). There would thus be no amino acids available to form proteins and no ribose required for RNA, no deoxyribose required for DNA, and none of the sugars required for carbohydrates. Furthermore, all of the phosphoric acid would have been precipitated as an insoluble salt with calcium, leaving none for the formation of RNA, DNA and other phosphoric acid containing compounds. Thus, even at this relatively simple stage in the origin of life, its formation by naturalistic processes can be excluded.

THE FORMATION OF COMPLEX MACROMOLECULES

The most primitive living cell imaginable would have to contain several hundred enzymes (all enzymes are proteins), as well as many other proteins, and hundreds, if not thousands, of RNA and DNA molecules. Proteins are composed of amino acids, with 20 different kinds of amino acids being found in present day proteins. The average protein contains about 400 amino acids. Most DNA and RNA molecules consist of several thousand nucleotides (there are four major kinds of nucleotides in DNA and RNA). It has recently been found that the gene that codes for blood clotting factor VIII contains 186,000 nucleotides. Each nucleotide consists of phosphoric acid, ribose (RNA) or deoxyribose (DNA) and a purine or a pyrimidine. A short section of a protein is shown in Figure 2 and a short section of a DNA molecule is shown in Figure 3.

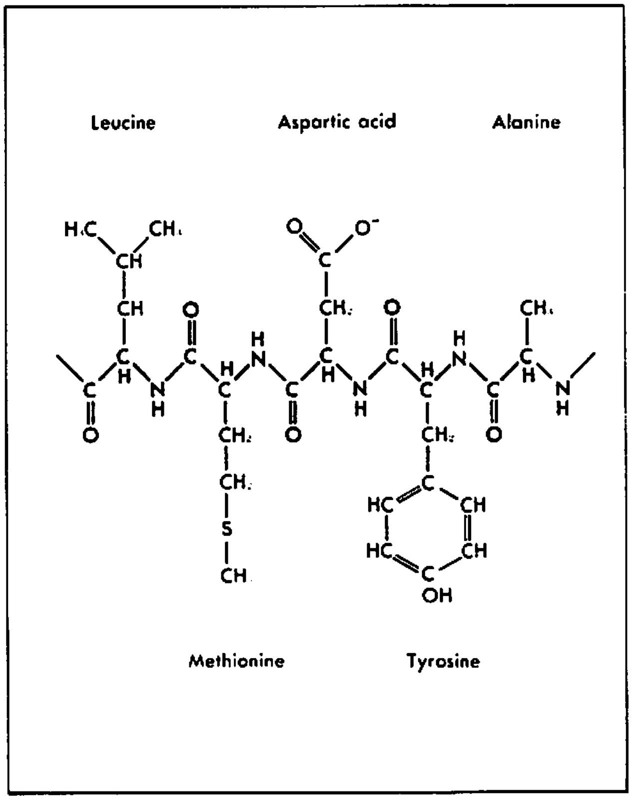

Figure 2. A short section of a protein

Two problems in the formation of proteins and nucleic acids are immediately obvious. To form a protein, chemical bonds between the amino acids must be formed, and to form DNA and RNA, chemical bonds between phosphoric acid, the sugar, and a purine or a pyrimidine must be formed. None of these bonds form spontaneously. Their formation requires the input of a large quantity of energy. The rupture of these bonds does occur easily and spontaneously, however. Rupture of these bonds, as occurs during hydrolysis, releases energy. Let us consider the formation of a DNA molecule of only 1,000 nucleotides, a rather small DNA molecule. To accomplish this, starting with the purines, pyrimidines, phosphoric acid, and sugars, would require the formation of approximately 3,000 chemical bonds, none of which would form spontaneously but each of which would require the input of a large quantity of energy. All of this would have to be accomplished before a single bond anywhere in the molecule ruptured. The rupture of these bonds occurs spontaneously and easily, releasing energy. What would be the probability, then, that the 3,000 chemical bonds would form before one chemical bond broke? The probability is essentially zero for all practical purposes. In fact, the probability that 20 such bonds would form before a breakage occurs is extremely low. The same thermodynamic considerations apply to the formation of proteins.

The second obvious difficulty in imagining a spontaneous evolutionary origin of proteins, RNA and DNA is the fact that the sub-units, that is, the amino acids of proteins, and the nucleotides of RNA and DNA, must be arranged in nearly precise sequence in order to produce biologically active substances. Ribonuclease, an enzyme that catalyzes the hydrolysis (digestion) of the ribonucleic acid we obtain in our food, is a rather small protein consisting of 124 amino acids. When these 124 amino acids are chemically bound to one another in the sequence found in ribonuclease, a protein results which has the remarkable ability of catalyzing the extremely rapid hydrolysis of RNA. If 188 of the same 20 different kinds of amino acids are arranged in a different but precise order, human growth hormone is obtained. Hemoglobin, the protein in red blood cells that binds oxygen, has a total of 287 amino acids arranged in precise order in two polypeptide chains. One protein is an enzyme, one is a hormone, and the third binds oxygen. The highly specific biological activity of each protein is due to the precise way the amino acids are arranged, just as the information conveyed by this sentence is determined by the precise sequence of the 190 letters found in it.

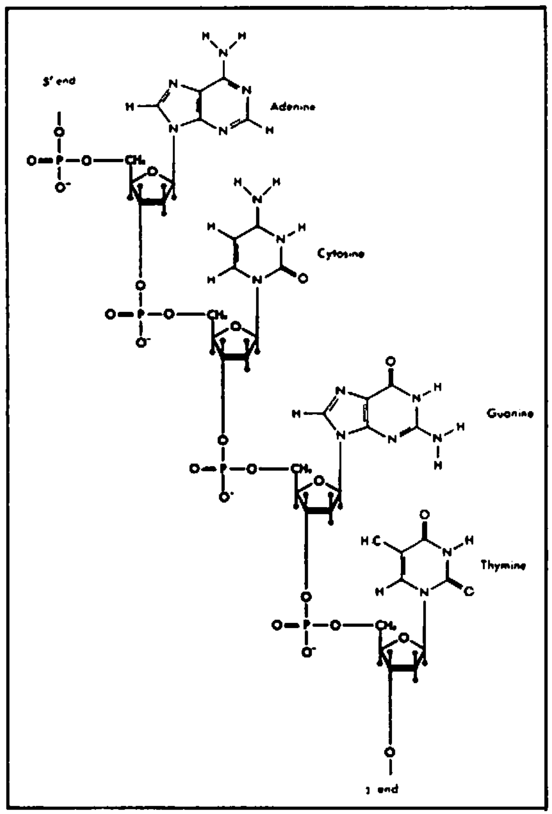

Figure 3. A short section of a DNA molecule

The evolutionist must believe that the hundreds of protein, DNA and RNA molecules necessary for the first form of life were all created by chance. No creator, no intelligence, no purpose was involved in their origin. According to origin of life theories, the natural random processes due to chemical and physical forces somehow managed to create all of these molecules.

The probability of such an event can be calculated. The primitive ocean, according to evolutionary scenarios, would have contained a much greater variety of amino acids than those now found in proteins. Furthermore, all except glycine would exist in two stereoisomeric forms, the L- and D- forms. All proteins that exist today contain exclusively the L- form. This fact in itself gives proof of deliberate, intelligent selection since chemistry alone would require equal quantities of the L- and D- forms. Let us ignore these important facts which would further vastly decrease the probability of obtaining a specific protein and assume that the primitive ocean contained vast quantities of each of the L- forms of the amino acids found in present day proteins. Now let us calculate the probability of obtaining by chance a protein of 100 amino acids arranged in a certain sequence. The probability of blindly choosing the correct amino acid at each position is 1/20. Since that event must be repeated 100 times, the probability of this happening by chance in 1/20 multiplied times itself 100 times. Thus the probability is 20^{-100}, which is equal to 10^{-130}, or one chance out of the number one followed by 130 zeroes!

It just so happens that approximately 10^{130} electrons could be packed into the visible universe, using every available cubic inch of space. Now let us pack the universe solidly with electrons, put your name on one of those electrons, and send you out into the universe to find the electron with your name on it. Let us further assume that we could rearrange the 100 amino acids in the protein as rapidly as you could examine a single electron. By the time you have found the electron with your name on it we will have managed, by chance, to arrange the 100 amino acids in the precise sequence required for our protein. Of course, you could hunt for trillions times trillions times trillions of years and much, much more without having a ghost of a chance of finding the electron with your name on it. The same would be true of producing the desired protein.

But supposing by some miracle the protein was produced in a finite amount of time. What would we have? One single molecule of one single protein! To get life started, however, we must have trillions of tons each of hundreds of different kinds of protein, DNA and RNA molecules. Of course, the probability of all of this happening on this earth in five billion years (or 5,000 billion years for that matter) is simply zero for all practical purposes. Hubert Yockey, utilizing information theory, calculated the probability of the evolution of a single gene. His results indicated that the most that could evolve by chance with 95% confidence was a single gene long enough to code for a single protein of 49 amino acids (13). Of course this is light years short of what would be required for a living cell.

Sir Fred Hoyle is one of the world's leading astronomers. A few years ago he and a colleague, Professor Chandra Wickramasinghe, became interested in the problem of the origin of life. When they began their studies each was an atheist (and an evolutionist, of course). They made certain assumptions about the minimum number of proteins of minimum length required for the first form of life. They then calculated the probability of these proteins evolving on earth in five billion years. The probability turned out to be $10^{-40,000}$, or one chance out of the number one followed by 40,000 zeroes. This is obviously flatly equal to zero. They then assumed that every star in the universe (10^{22} or more) has a planet like the earth and that the universe is 20 billion years old. They then calculated the probability of life evolving somewhere in the universe in 20 billion years. For all practical purposes the probability was zero (14). Hoyle concluded that the probability of the evolution of life is equal to the probability that a tornado sweeping through a junkyard would assemble a Boeing 747! Hoyle and Wickramasinghe have declared that the evolution of life is a physical impossibility, therefore it had to be created, therefore there must be a God!

THE ORIGIN OF COMPLEX SYSTEMS

Even if the oceans were full of every conceivable protein, DNA, and RNA molecule and all other molecules necessary for life, not a single living cell could be produced. The most primitive cell imaginable would require a complex, dynamically functioning membrane, protein factories, energy factories, the incredibly complex genetic apparatus required for its reproduction, and many other complex structures. Furthermore, all of this must be precisely coordinated in time and space for the cell to be alive and functioning. There is no natural tendency, however, for complex systems to spontaneously arise from simple systems. In fact, precisely the reverse is true. The universal natural tendency is for all systems to go from order to disorder, from complex to simple. This tendency is so all-pervasive, so unfailing it is found in an expression known as the Second Law of Thermodynamics, or the law of increasing entropy, entropy being a measure of the randomness, or lack of orderliness of the system. The probability of a living cell spontaneously assembling itself, whether all at once or through a long, step-wise process, starting with all of the necessary molecules dissolved in the primitive ocean, is simply zero.

Here, again, a very simple but very powerful principle presents an insuperable barrier to the origin of life. The assembly of the complex macromolecules into the many complex structures and systems found in living cells, and the further assembly of these systems in the precise manner required for the origin of the first living cell, had to occur naturally and spontaneously if life evolved. This hypothetical self-organization of complex, precisely ordered systems from a chaotic mixture of the molecules, however, is directly contradictory to common experience, an experience that has been so free of exceptions the principle has been incorporated into a natural law, the Second Law of Thermodynamics. At this juncture, once again, evolution theory is directly contradicted by proven principles.

CONCLUSION

Even this very brief examination of the problems and processes involved in origin of life theories is sufficient to conclude that a materialistic, mechanistic, evolutionary origin of life is directly contradicted by known natural laws and processes. The origin of life could only have occurred through the acts of an omniscient Creator independent of and external to the natural universe. "In the beginning God created" is still the most up-to-date statement we can make concerning the origin of life.

SUGGESTED READING

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