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Exposing the Myth of Evolution

Why Abiogenesis Is Impossible

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If naturalistic molecules-to-human-life evolution were true, multibillions of links are required to bridge modern humans with the chemicals that once existed in the hypothetical "primitive soup". This putative soup, assumed by many scientists to have given birth to life over 3.5 billion years ago, was located in the ocean or mud puddles. Others argue that the origin of life could not have been in the sea but rather must have occurred in clay on dry land. Still others conclude that abiogenesis was more likely to have occurred in hot vents. It is widely recognized that major scientific problems exist with all naturalistic origin of life scenarios. This is made clear in the conclusions of many leading origin-of-life researchers. A major aspect of the abiogenesis question is "What is the minimum number of parts necessary for an autotrophic free living organism to live, and could these parts assemble by naturalistic means?" Research shows that at the lowest level this number is in the multimillions, producing an irreducible level of complexity that cannot be bridged by any known natural means.

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Introduction

Abiogenesis is the theory that life can arise spontaneously from non-life molecules under proper conditions. Evidence for a large number of transitional forms to bridge the stages of this process is critical to prove the abiogenesis theory, especially during the early stages of the process. The view of how life originally developed from non-life to an organism capable of independent life and reproduction presented by the mass media is very similar to the following widely publicized account:

> 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*

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> *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 (from the Emmy award winning PBS NOVA film *The Miracle of Life* quoted in Hanegraaff, 1998, p. 70, emphasis in original).

Science textbook authors Wynn and Wiggins describe the abiogenesis process currently accepted by Darwinists:

> Aristotle believed that decaying material could be transformed by the "spontaneous action of Nature" into living animals. His hypothesis was ultimately rejected, but... Aristotle's hypothesis has been replaced by *another* spontaneous generation hypothesis, one that requires billions of years to go from the molecules of the universe to cells, and then, via random mutation/natural selection, from cells to the variety of organisms living today. This version, which postulates chance happenings eventually leading to the phenomenon of life, is biology's Theory of Evolution (1997, p. 105).

The question on which this paper focuses is "How much evidence exists for this view of life's origin?" When Darwinists discuss "missing links" they often imply that relatively few links are missing in what is a rather complete chain which connects the putative chemical precursors of life that is theorized to have existed an estimated 3.5 billion years ago to all life forms existing today. Standen noted a half century ago that the term "missing link" is misleading because it suggests that only *one* link is missing whereas it is more accurate to state that *so many links are missing* that it is not evident whether there was ever a chain (Standen, 1950, p. 106). This assertion now has been well documented by many creationists and others (see Bergman, 1998; Gish, 1995; Lubenow, 1994, 1992; Rodabaugh, 1976; and Moore, 1976).

Scientists not only have been unable to find a *single undisputed link* that clearly connects *two of the hundreds of major family groups*, but they have not even been able to produce a plausible starting point for their hypothetical evolutionary chain (Shapiro, 1986). The first links— actually the first hundreds of thousands or more links that are required to produce life—still are missing (Behe, 1996, pp. 154–156)! Horgan concluded that if he were a creationist today he would focus on the origin of life because this

> ...is by far the weakest strut of the chassis of modern biology. The origin of life is a science writer's dream. It abounds with exotic scientists and exotic theories, which are never entirely abandoned or accepted, but merely go in and out of fashion (1996, p. 138).

The major links in the molecules-to-man theory that must be bridged include (a) evolution of simple molecules into complex molecules, (b) evolution of complex molecules into simple organic molecules, (c) evolution of simple organic molecules into complex organic molecules, (d) eventual evolution of complex organic molecules into DNA or similar information storage molecules, and (e) eventually evolution into the first cells. This process requires multimillions of links, all which either are missing or controversial. Scientists even lack plausible just-so stories for most of evolution. Furthermore the parts required to provide life clearly have specifications that rule out most substitutions.

> In the entire realm of science no class of molecule is currently known which can remotely compete with proteins. *It seems increasingly unlikely that the abilities of proteins could be realized to the same degree in any other material form.* Proteins are not only unique, but give every impression of being ideally adapted for their role as the universal constructor devices of the cell ... Again, we have an example in which the only feasible candidate for a particular biological role gives every impression of being supremely fit for that role (Denton, 1998, p. 188, emphasis in original).

The logical order in which life developed is hypothesized to include the following basic major stages:

1. Certain simple molecules underwent spontaneous, random chemical reactions until after about half-a-billion years complex organic molecules were produced.

2. Molecules that could replicate eventually were formed (the most common guess is nucleic acid molecules), along with enzymes and nutrient molecules that were surrounded by membraned cells.
3. Cells eventually somehow "learned" how to reproduce by copying a DNA molecule (which contains a complete set of instructions for building a next generation of cells). During the reproduction process, the mutations changed the DNA code and produced cells that differed from the originals.
4. The variety of cells generated by this process eventually developed the machinery required to do all that was necessary to survive, reproduce, and create the next generation of cells in their likeness. Those cells that were better able to survive became more numerous in the population (adapted from Wynn and Wiggins, 1997, p. 172).

The problem of the early evolution of life and the unfounded optimism of scientists was well put by Dawkins. He concluded that Earth's chemistry was different on our early, lifeless, planet, and that at this time there existed

> ...no life, no biology, only physics and chemistry, and the details of the Earth's chemistry were very different. Most, though not all, of the informed speculation begins in what has been called the primeval soup, a weak broth of simple organic chemicals in the sea. Nobody knows how it happened but, somehow, without violating the laws of physics and chemistry, a molecule arose that just happened to have the property of self-copying—a replicator. This may seem like a big stroke of luck... Freakish or not, this kind of luck does happen... [and] it had to happen only once... What is more, as far as we know, it may have happened on only one planet out of a billion billion planets in the universe. Of course many people think that it actually happened on lots and lots of planets, but we only have *evidence* that it happened on one planet, after a lapse of half a billion to a billion years. So the sort of lucky event we are looking at *could* be so wildly improbable that the chances of its happening, somewhere in the universe, could be as low as one in a billion billion billion in any one year. If it *did* happen on only one planet, anywhere in the universe, that planet has to be our planet—because here we are talking about it (Dawkins, 1996, pp. 282–283, emphasis in original).

The Evidence for the Early Steps of Evolution

The first step in evolution was the development of simple self-copying molecules consisting of carbon dioxide, water and other inorganic compounds. No one has proven that a simple self-copying molecule can self-generate a compound such as DNA. Nor has anyone been able to create one in a laboratory or even on paper. The hypothetical weak "primeval soup" was not like soups experienced by humans but was highly diluted, likely close to pure water. The process is described as life having originated

> spontaneously from organic compounds in the oceans of the primitive Earth. The proposal assumes that primitive oceans contained large quantities of simple organic compounds that reacted to form structures of greater and greater complexity, until there arose a structure that we would call living. In other words, the first living organism developed by means of a series of nonbiological steps, none of which would be highly improbably on the basis of what is know today. This theory, [was] first set forth clearly by A.I. Oparin (1938) ... (Newman, 1967, p. 662).

An astounding number of speculations, models, theories and controversies still surround every aspect of the origin of life problem (Lahav 1999). Although some early scientists proposed that "organic life ... is eternal," most realized it must have come "into existence at a certain period in the past" (Haeckel, 1905, p. 339). It now is acknowledged that the first living organism could not have arisen directly from inorganic matter (water, carbon dioxide, and other inorganic nutrients) even as a result of some extraordinary event. Before the explosive growth of our knowledge of the cell during the last 30 years, it was known that "the simplest bacteria are extremely complex, and the chances of their arising directly from inorganic materials, with no steps in between, are too remote to consider seriously." (Newman, 1967, p. 662). Most major discoveries about cell biology and molecular biology have been made since then.

Search for the Evidence of Earliest Life

Theories abound, but no direct evidence for the beginning of the theoretical evolutionary climb of life up what Richard Dawkins and many evolutionists call "mount improbable" ever has been discovered (Dawkins, 1996). Nor have researchers been able to develop a plausible theory to explain how life *could* evolve from non-life. Many equally implausible theories now exist, most of which are based primarily on speculation. The ancients believed life originated by spontaneous generation from inanimate matter or once living but now dead matter. Aristotle even believed that under the proper conditions putatively "simple" animals such as worms, fleas, mice, and dogs could spring to life spontaneously from moist "Mother Earth."

The spontaneous generation of life theory eventually was proved false by hundreds of research studies such as the 1668 experiment by Italian physician Francesco Redi (1626–1697). In one of the first controlled biological experiments, Redi proved that maggots appeared in meat *only* after flies had deposited their eggs on it (Jenkens- Jones, 1997). Maggots do not spontaneously generate on their own as previously believed by less rigorous experimenters.

Despite Redi's evidence, however, the belief in spontaneous generation of life was so strong in the 1600s that even Redi continued to believe that spontaneous generation could occur *in certain instances.* After the microscope proved the existence of bacteria in l683, many scientists concluded that these "simple" microscopic organisms must have "spontaneously generated," thereby providing evolution with its beginning. Pasteur and other researchers, though, soon disproved this idea, and the fields of microbiology and biochemistry have since documented quite eloquently the enormous complexity of these compact living creatures (Black, 1998).

Nearly all biologists were convinced by the latter half of the nineteenth century that spontaneous generation of all types of living organisms was impossible (Bergman, 1993a). Now that naturalism dominates science, Darwinists reason that at least one spontaneous generation of life event *must* have occurred in the distant past because no other naturalistic origin-of-life method exists aside from panspermia, which only moves the spontaneous generation of life event elsewhere (Bergman, 1993b). As theism was filtered out of science, spontaneous generation gradually was resurrected in spite of its previous defeat. The solution was to add a large amount of time to the broth:

> Aristotle believed that decaying material could be transformed by the "spontaneous action of Nature" into living animals. His hypothesis was ultimately rejected, but, in a way, he might not have been completely wrong. Aristotle's hypothesis has been replaced by *another* spontaneous generation hypothesis, one that requires billions of years to go from the molecules of the universe to cells, and then, *via random mutation/natural selection,* from cells to the variety of organisms living today. This version, which postulates chance happenings eventually leading to the phenomenon of life, is biology's Theory of Evolution (Wynn and Wiggins, 1997, p. 105, emphasis mine).

Although this view now is widely accepted among evolutionists, no one has been able to locate convincing fossil (or other) evidence to support it. The plausibility of abiogenesis has changed greatly in recent years due to research in molecular biology that has revealed exactly how complex life is, and how much evidence exists against the probability of spontaneous generation. In the 1870s and 1880s scientists believed that devising a plausible explanation for the origin of life

> would be fairly easy. For one thing, they assumed that life was essentially a rather simple substance called protoplasm that could be easily constructed by combining and recombining simple chemicals such as carbon dioxide, oxygen, and nitrogen (Meyer, 1996, p. 25).

The German evolutionary biologist Ernst Haeckel (1925) even referred to monera cells as simple homogeneous globules of plasm. Haeckel believed that a living cell about as complex as a bowl of Jell-o ® could exist, and his origin of life theory reflected this completely erroneous view. He even concluded that cell "autogony" (the term he used to describe living things' ability to reproduce) was similar to the process of inorganic crystallization. In his words:

> The most ancient organisms which arose by spontaneous generation—the original parents of all subsequent organisms—must necessarily be supposed to have been Monera—simple, soft, albuminous lumps of plasma, without structure, without any definite form, and entirely without any hard and formed parts.

About the same time T. H. Huxley proposed a simple two-step method of chemical recombination that he thought could explain the origin of the first living cell. Both Haeckel and Huxley thought that just as salt could be produced spontaneously by mixing powered sodium metal and heated chlorine gas, a living cell could be produced by mixing the few chemicals they believed were required. Haeckel taught that the basis of life is a substance called "plasm," and this plasm constitutes

> the material foundations of the phenomena of life ... All the other materials that we find in the living organism are products or derivatives of the active plasm: In view of the extraordinary significance which we must assign to the plasm—as the universal vehicle of all the vital phenomena [or as Huxley said "the physical basis of life"]—it is very important to understand clearly all its properties, especially the chemical ones ... In every case where we have with great difficulty succeeded in examining the plasm as far as possible and separating it from the plasma-products, it has the appearance of a colorless, viscous substance, the chief physical property of which is its peculiar thickness and consistency ... Active living protoplasm ... is best compared to a cold jelly or solution of glue (1905 pp. 121,123).

Once the brew was mixed, eons of time allowed spontaneous chemical reactions to produce the simple "protoplasmic substance" that scientists once assumed to be the essence of life (Meyer, 1996, p. 25). As late as 1928, the germ cell still was thought to be relatively simple and

> ...no one now questions that individual development everywhere consists of progress from a relatively simple to a relatively complex form. Development is not the unfolding of an infolded organism; it is the formation of new structures and functions by combinations and transformations of the relatively simple structures and functions of the germ cells (Conklin, 1928, pp. 63–64).

Cytologists now realize that a living cell contains hundreds of thousands of different complex parts such as various motor proteins that are assembled to produce the most complex "machine" in the Universe—a machine far more complex than the most complex Cray super computer. We now also realize after a century of research that the eukaryote protozoa thought to be as simple as a bowl of gelatin in Darwin's day actually are enormously more complex than the prokaryote cell. Furthermore, molecular biology has demonstrated that the basic design of the cell is

> essentially the same in all living systems on earth from bacteria to mammals... In terms of their basic biochemical design... no living system can be thought of as being primitive or ancestral with respect to any other system, nor is there the slightest empirical hint of an evolutionary sequence among all the incredibly diverse cells on earth (Denton, 1986, p. 250).

This is a major problem for Darwinism because life at the cellular level generally does not reveal a gradual increase in complexity as it ascends the evolutionary ladder from protozoa to humans. The reason that all cells are basically alike is because the basic biochemical requirements and constraints for all life are the same:

> A curious similarity underlies the seemingly varied forms of life we see on the earth today: the most central molecular machinery of modern organisms has always been found to be essentially the same. This unity of biochemistry has surely been one of the great discoveries of the past 100 years (Cairns-Smith, 1985, p. 90).

The most critical gap that must be explained is that between life and non-life because

> Cells and organisms are very complex... [and] there is a surprising uniformity among living things. We know from DNA sequence analyses that plants and higher animals are closely related, not only to each other, but to relatively simple single-celled organisms such as yeasts. Cells are so similar in their structure and function that many of their proteins can be interchanged

> from one organism to another. For example, yeast cells share with human cells many of the central molecules that regulate their cell cycle, and several of the human proteins will substitute in the yeast cell for their yeast equivalents! (Alberts, 1992, p. xii).

The *belief* that spontaneous regeneration, while admittedly very rare, is still attractive as illustrated by Sagan and Leonard's conclusion, "Most scientists agree that life will appear spontaneously in any place where conditions remain sufficiently favorable for a very long time" (1972, p. 9). This claim then is followed by an admission from Sagan and Leonard that raises doubts not only about abiogenesis, but about Darwinism generally, namely, "this conviction [about the origin of life] is based on inferences and extrapolations." The many problems, inferences, and extrapolations needed to create abiogenesis just-so stories once were candidly admitted by Dawkins:

> An origin of life, anywhere, consists of the chance arising of a self-replicating entity. Nowadays, the replicator that matters on Earth is the DNA molecule, but the original replicator probably was not DNA. We don't know what it was. Unlike DNA, the original replicating molecules cannot have relied upon complicated machinery to duplicate them. Although, in some sense, they must have been equivalent to "Duplicate me" instructions, the "language" in which the instructions were written was not a highly formalized language such that only a complicated machine could obey them. The original replicator cannot have needed elaborate decoding, as DNA instructions... do today. Self-duplication was an inherent property of the entity's structure just as, say, hardness is an inherent property of a diamond... the original replicators, unlike their later successors the DNA molecules, did not have complicated decoding and instruction-obeying machinery, because complicated machinery is the kind of thing that arises in the world only after many generations of evolution. And evolution does not get started until there are replicators. In the teeth of the so-called "Catch-22 of the origin of life"... the original self-duplicating entities must have been simple enough to arise by the spontaneous accidents of chemistry (1996, p. 285).

The method used in constructing these hypothetical replicators is not stated, nor has it ever been demonstrated to exist either in the laboratory or on paper. The difficulties of terrestrial abiogenesis are so great that some evolutionists have hypothesized that life could not have originated on earth but must have been transported here from another planet via star dust, meteors, comets, or spaceships (Bergman, 1993b)! As noted above, panspermia does not solve the origin of life problem though, but instead moves the abiogenesis problem elsewhere. Furthermore, since so far as we know no living organism can survive very long in space because of cosmic rays and other radiation, "this theory is ... highly dubious, although it has not been disproved; also, it does not answer the question of where or how life did originate" (Newman, 1967, p. 662).

Darwin evidentially recognized how serious the abiogenesis problem was for his theory, and once even conceded that all existing terrestrial life must have descended from some primitive life form that was called into life "by the Creator" (1900, p. 316). But to admit, as Darwin did, the possibility of *one* or *a few creations is to open the door to the possibility of many or even thousands*! If God made one animal type, He also could have made two or many thousands of different types. No contemporary hypothesis today has provided a viable explanation as to how the abiogenesis origin of life could occur by naturalistic means. The problems are so serious that the majority of evolutionists today tend to shun the whole subject of abiogenesis.

History of Modern Abiogenesis Research

The "warm soup" theory, still the most widely held theory of abiogenesis among evolutionists, was developed most extensively by Russian scientist A.I. Oparin in the 1920s. The theory held that life evolved when organic molecules rained into the primitive oceans from an atmospheric soup of chemicals interacting with solar energy. Later Haldane (1928), Bernal (1947) and Urey (1952) published their research to try to support this model, all with little success. Then came what some felt was a breakthrough by Harold Urey and his graduate student Stanley Miller in the early 1950s.

The most famous origin of life experiment was completed in 1953 by Stanley Miller at the University of Chicago. At the time Miller was a 23-year-old graduate student working under Urey who was trying to recreate in his laboratory the conditions then thought to have preceded the origin of life. The Miller/Urey experiments involved filling a sealed glass apparatus with methane, ammonia, hydrogen gases (representing what they thought composed the early atmosphere) and water vapor (to simulate the ocean). Next, they used a spark-discharge device to strike the gases in the flask with simulated lightning while a heating coil kept the water boiling. Within a few days, the water and gas mix produced a reddish stain on the sides of the flask. After analyzing the substances that had been formed, they found several types of amino acids. Eventually Miller and other scientists were able to produce 10 of the 20 amino acids required for life by techniques similar to the original Miller/ Urey experiments.

Urey and Miller assumed that the results were significant because some of the organic compounds produced were the building blocks of proteins, the basic structure of all life (Horgan, 1996, p. 130). Although widely heralded by the press as "proving" the origin of life could have occurred on the early earth under natural conditions without intelligence, the experiment actually provided compelling evidence for exactly the opposite conclusion. For example, equal quantities of both right- and left-handed organic molecules always were produced by the Urey/Miller procedure. In real life, nearly all amino acids found in proteins are left handed, almost all polymers of carbohydrates are right handed, and the opposite type can be toxic to the cell. In a summary the famous Urey/Miller origin-of-life experiment, Horgan concluded:

> Miller's results seem to provide stunning evidence that life could arise from what the British chemist J.B.S. Haldane had called the "primordial soup." Pundits speculated that scientists, like Mary Shelley's Dr. Frankenstein, would shortly conjure up living organisms in their laboratories and thereby demonstrate in detail how genesis unfolded. It hasn't worked out that way. In fact, almost 40 years after his original experiment, Miller told me that solving the riddle of the origin of life had turned out to be more difficult than he or anyone else had envisioned (1996, p. 138).

The reasons why creating life in a test tube turned out to be far more difficult than Miller or anyone else expected are numerous and include the fact that scientists now know that the complexity of life is far greater than Miller or anyone else in pre-DNA revolution 1953 ever imagined. Actually life is far more complex and contains far more information than anyone in the 1980s believed possible. In an interview with Miller, now considered one of "the most diligent and respected origin-of-life researchers," Horgan reported that after Miller completed his 1953 experiment, he

> ...dedicated himself to the search for the secret of life. He developed a reputation as both a rigorous experimentalist and a bit of a curmudgeon, someone who is quick to criticize what he feels is shoddy work....he fretted that his field still had a reputation as a fringe discipline, not worthy of serious pursuit.... Miller seemed unimpressed with any of the current proposals on the origin of life, referring to them as "nonsense" or "paper chemistry." He was so contemptuous of some hypotheses that, when I asked his opinion of them, he merely shook his head, sighed deeply, and snickered—as if overcome by the folly of humanity. Stuart Kauffman's theory of autocatalysis fell into this category. "Running equations through a computer does not constitute an experiment," Miller sniffed. Miller acknowledged that scientists may never know precisely where and when life emerged. "We're trying to discuss a historical event, which is very different from the usual kind of science, and so criteria and methods are very different," he remarked... (Horgan, 1996, p. 139).

The major problem of Millers experiment is well put by Davies,

> Making the building blocks of life is easy—amino acids have been found in meteorites and even in outer space. But just as bricks alone don't make a house, so it takes more than a random collection of amino acids to make life. Like house bricks, the building blocks of life have to be assembled in a very specific and exceedingly elaborate way before they have the desired function (Davies, 1999, p. 28).

We now realize that the Urey/Miller experiments did not produce evidence for abiogenesis because, although amino acids are the building blocks of life, the key to life is information (Pigliucci, 1999; Dembski, 1998). Natural objects in forms resembling the English alphabet (circles, straight lines and similar) abound in nature, but this does not help us to understand the origin of information (such as that in Shakespear's plays) because this task requires intelligence both to create the information (the play) and then to translate that information into symbols. What must be explained is the *source of the information* in the text (the words and ideas), not the existence of circles and straight lines. Likewise, the information contained in the genome must be explained (Dembski, 1998). Complicating the situation is the fact that

> research has since drawn Miller's hypothetical atmosphere into question, causing many scientists to doubt the relevance of his findings. Recently, scientists have focused on an even more exotic amino acid source: meteorites. Chyba is one of several researchers who have evidence that extraterrestrial amino acids may have hitched a ride to Earth on far flung space rocks (Simpson, 1999, p. 26).

Yet another difficulty is, even if the source of the amino acids and the many other compounds needed for life could be explained, it still must be explained as to how these many diverse elements became aggregated in the same area and then properly assembled themselves. This problem is a major stumbling block to any theory of abiogenesis:

> ...no one has ever satisfactorily explained how the widely distributed ingredients linked up into proteins. Presumed conditions of primordial Earth would have driven the amino acids toward lonely isolation. That's one of the strongest reasons that Wächtershäuser, Morowitz, and other hydrothermal vent theorists want to move the kitchen [that cooked life] to the ocean floor. If the process starts down deep at discrete vents, they say, it can build amino acids—and link them up—right there (Simpson, 1999, p. 26).

Several recent discoveries have led some scientists to conclude that life may have arisen in submarine vents whose temperatures approach 350° C. Unfortunately for both warm pond and hydrothermal vent theorists, heat may be the downfall of their theory.

Heat and Biochemical Degradation Problems

Charles Darwin's hypothesis that life first originated on earth in a warm little pond somewhere on a primitive earth has been used widely by most nontheists for over a century in attempts to explain the origin of life. Several reasons exist for favoring a warm environment for the start of life on earth. A major reason is that the putative oldest known organisms on earth are alleged to be hyperthermophiles that require temperatures between 80° and 110° C in order to thrive (Levy and Miller, 1998). In addition some atmospheric models have concluded that the surface temperature of the early earth was much higher than it is today.

A major drawback of the "warm little pond" origin- of-life theory is its apparent ability to produce sufficient concentrations of the many complex compounds required to construct the first living organisms. These compounds must be sufficiently stable to insure that the balance between synthesis and degradation favors synthesis (Levy and Miller, 1998). The warm pond and hot vent theories also have been seriously disputed by experimental research that has found the half-lives of many critically important compounds needed for life to be far "too short to allow for the adequate accumulation of these compounds" (Levy and Miller, 1998, p. 7933). Furthermore, research has documented that "unless the origin of life took place extremely rapidly (in less than 100 years), we conclude that a high temperature origin of life... cannot involve adenine, uracil, guanine or cytosine" because these compounds break down far too fast in a warm environment. In a hydrothermal environment, most of these compounds could neither form in the first place, nor exist for a significant amount of time (Levy and Miller, p. 7933).

As Levy and Miller explain, "the rapid rates of hydrolysis of the nucleotide bases A,U,G and T at temperatures much above 0° Celsius would present a major problem in the accumulation of these presumed essential components on the early earth" (p. 7933). For this reason, Levy and Miller postulated that either a two-letter code or an alternative base pair was used instead. This requires the development of an entirely *different kind* of life, a conclusion that is not only highly speculative, but likely impossible because no other known compounds have the required properties for life that adenine, uracil, guanine and cytosine possess. Furthermore, this would require life to evolve based on a hypothetical two-letter code or alternative base pair system. Then life would have to *re-evolve* into a radically new form based on the present code, a change that appears to be impossible according to our current understanding of molecular biology.

Furthermore, the authors found that, given the minimal time perceived to be necessary for evolution to occur, cytosine is unstable *even at temperatures as cold as 0º C.* Without cytosine neither DNA or RNA can exist. One of the main problems with Miller's theory is that his experimental methodology has not been able to produce much more than a few amino acids which actually lend little or no insight into possible mechanisms of abiogenesis.

> Even the simpler molecules are produced only in small amounts in realistic experiments simulating possible primitive earth conditions. What is worse, these molecules are generally minor constituents of tars: It remains problematical how they could have been separated and purified through geochemical processes whose normal effects are to make organic mixtures more and more of a jumble. With somewhat more complex molecules these difficulties rapidly increase. In particular a purely geochemical origin of nucleotides (the subunits of DNA and RNA) presents great difficulties. In any case, nucleotides have not yet been produced in realistic experiments of the kind Miller did. (Cairns-Smith, 1985, p. 90).

Postulating alternative codes for an origin-of-life event at temperatures close to the freezing point of water is a rationalization designed to overcome what appears to be a set of insurmountable problems for the abiogenesis theory. Given these problems, why do so many biologists believe that life on earth originated by spontaneous generation under favorable conditions? Yockey concludes that although Miller's paradigm was at one time

> worth consideration, now the entire effort in the primeval soup paradigm is self-deception based on the ideology of its champions... The history of science shows that a paradigm, once it has achieved the status of acceptance (and is incorporated in textbooks) and regardless of its failures, is declared invalid only when a new paradigm is available to replace it ... It is a characteristic of the true believer in religion, philosophy and ideology that he must have a set of beliefs, come what may... There is no reason that this should be different in the research on the origin of life ...Belief in a primeval soup on the grounds that no other paradigm is available is an example of the logical *fallacy of the false alternative*... (Yockey, 1992, p. 336 emphasis in original).

The many problems with the warm soup model have motivated the development of many other abiogenesis models. One is the cold temperature model that is gaining in acceptance as the flaws of the hot model become more obvious. As Vogel notes, many researchers still

> argue that the first cells arose in the scalding waters of hot springs or geothermal vents, while a small but prominent band of holdouts insists on cool pools or even cold oceans. With no fossils to go by, the argument has circled a variety of indirect clues ... But now ... comes good news from the cold camp: Evidence from the genes of living organisms suggests that the cell that gave rise to all of today's life-forms was ill-suited for extremely hot conditions (Vogel, 1999, p. 155).

Based on a geochemical assessment, Thaxton, Bradley, and Olsen (1984 p. 66) concluded that in the atmosphere the "many destructive interactions would have so vastly diminished, if not altogether consumed, essential precursor chemicals, that chemical evolution rates would have been negligible" in the various water basins on the primitive earth. They concluded that the "soup" would have been far too diluted for direct polymerization to occur. Even local ponds where some concentrating of soup ingredients may have occurred would have met with the same problem.

> Furthermore, no geological evidence indicates an organic soup, even a small organic pond, ever existed on this planet. It is becoming clear that however life began on earth, the usually conceived notion that life emerged from an oceanic soup of organic chemicals is a most implausible hypothesis. We may therefore with fairness call this scenario "the myth of the prebiotic soup" (Thaxton, Bradley, and Olsen, 1984, p. 66).

It also is theorized that life must have begun in clay because the "clay-life" explanation explains several problems not explained by the "primordial soup" theory. Graham Cairns-Smith of the

University of Scotland first proposed the clay-life theory about 40 years ago, and many scientists have since come to believe that life on earth must have began from clay rather than in the the warm little pond as proposed by Darwin. The clay-life theory holds that an accumulation of chemicals produced in clay by the sun eventually led to the hypothetical self-replicating molecules that evolved into cells and then eventually into all life forms on earth today.

The theory argues that only clay has the two essential properties necessary for life: the capacity to both store and transfer energy. Furthermore, because some clay components have the ability to act as catalysts, clay is capable of some of the same lifelike attributes as those exhibited by enzymes. Additionally the mineral structure of certain clays are almost as intricate as some organic molecules. However, the clay theory suffered from its own set of problems, and as a result has been discarded by most theorists. At the very least, the Stanley Miller experiments proved that amino acids can be formed under certain conditions. The clay theory has yet to achieve even this much. As a result, Miller's experiments continue to be cited because no other viable source exists for the production of amino acids. Now, the hot thermal vent theory is being discussed once again by many as an alternative although, as noted above, it too suffers from potentially lethal problems.

What is Needed to Produce Life

Naturalism requires enormously long periods of time to allow non-living matter to evolve into the hypothetical speck of viable protoplasm needed to start the process that results in life. Even *more* time is needed to evolve the protoplasm into the enormous variety of highly organized complex life forms that have been found in Cambrian rocks. Neo-Darwinism suggests that life originated over 3.5 billion years ago, yet a rich fossil record for less than roughly 600 million years commonly is claimed. Consequently, almost all the record is missing, and evidence for the most critical two billion years of evolution is sparse at best with what little actually exists being highly equivocal.

A major issue then, in abiogenesis is "what is the *minimum* number of possible parts that allows something to live?" The number of parts needed is large, but how large is difficult to determine. In order to be considered "alive," an organism must possess the ability to metabolize and assimilate food, to respirate, to grow, to reproduce and to respond to stimuli (a trait known as irritability). These criteria were developed by biologists who were trying to understand the process we call life. Although these criteria are not perfect, they are useful in spite of cases that seem to contradict our definition. A mule, for instance, cannot usually reproduce but clearly is alive, and a crystal can "reproduce" but clearly is not alive. One attempt by an evolutionist to determine what is needed in order to self-replicate produced the following conclusions:

> If we ditch the selfish-replicator illusion, and accept that the only known biological entity capable of autonomous replication is the cell (full of cooperating genes and proteins, etc.)... DNA replication is so error-prone that it needs the prior existence of protein enzymes to improve the copying fidelity of a gene-size piece of DNA. "Catch-22," say Maynard Smith and Szathmary. So, wheel on RNA with its now recognized properties of carrying both informational and enzymatic activity, leading the authors to state: "In essence, the first RNA molecules did not need a protein polymerase to replicate them; they replicated themselves." Is this a fact or a hope? I would have thought it relevant to point out for 'biologists in general' that not one self-replicating RNA has emerged to date from quadrillions (10^{24}) of artificially synthesized, random RNA sequences (Dover, 1999, p. 218).

The cell, then appears to be the only biological entity that self-reproduces and simultaneously possesses the other traits required for life. The question then becomes "What is the *simplest* cell that can exist?"

Many bacteria and all viruses possess less complexity than required for an organism normally defined as "living," and for this reason must live as parasites which require the existence of complex cells in order to reproduce. For this reason Trefil noted that the question of where viruses come from is an "enduring mystery" in evolution. Viruses usually are much smaller than parasitic bacteria and are not considered alive because they must rely on their host even more than bacteria do. Viruses consist primarily of a coat of proteins surrounding DNA or RNA that contains a handful of genes, and since they do not

> ... reproduce in the normal way, it's hard to see how they could have gotten started. One theory: they are parasites who, over a long period of time, have lost the ability to reproduce independently... Viruses are among the smallest of "living" things. A typical virus, like the one that causes ordinary influenza, may be no more than a thousand atoms across. This is in comparison with cells which may be hundreds or even thousands of times that size. Its small size is one reason that it is so easy for a virus to spread from one host to another—it's hard to filter out anything that small (Trefil, 1992, p. 91).

In order to reproduce, a virus's genes must invade a living cell and take control of its much larger DNA. A bacterium is 400 times greater in size than the smallest known virus, while a typical human cell averages 200 times larger than the smallest known bacterium. The QB virus is only 24 nanometers long, contains only 3 genes and is almost 20 times smaller than *Escherichia coli,* billions of which inhabit the human intestines. *E. coli* is 1,000 nanometers long compared to a typical human cell that is about 10,000 nanometers long (1 nanometer equals 1 billionth of a meter, or about 1/25-millionths of an inch) and contains an estimated 100,000 genes. Researchers have detected microbes in human and bovine blood that are only 2-millionths of an inch in diameter, but these organisms cannot live on their own because they need more than simple inorganic, or common inorganic molecules to survive.

Since parasites lack many of the genes (and other biological machinery) required to survive on their own, in order to grow and reproduce they must obtain the nutrients and other services they require from the organisms that serve as their hosts. Independent free-living creatures such as people, mice and roses are far more complex than organisms like parasites and viruses that are dependent on these complex free-living organisms. Abiogenesis theory requires that the first life forms consisted of free-living autotrophs (i.e. organisms that are able to manufacture their own food) since the complex life forms needed to sustain heterotrophs (organisms that cannot manufacture their own food) did not exist until later.

Most extremely small organisms existing today are dependent on other, more complex organisms. Some organisms can overcome their lack of size and genes by borrowing genes from their hosts or by gorging on a rich broth of organic chemicals like blood. Some microbes live in colonies in which different members provide different services. Unless one postulates the unlikely scenario of the simultaneous spontaneous generation of *many different organisms*, one has to demonstrate the evolution of an organism that can survive on its own, or with others like itself, as a symbiont or cannibal. Consequently, the putative first life forms must have been much more complex than most examples of "simple" life known to exist today.

The simplest microorganisms, Chlamydia and Rickettsea, are the smallest living things known, but also are both parasites and thus too simple to be the first life. Only a few hundred atoms across, they are smaller than the largest virus and have about half as much DNA as do other species of bacteria. Although they are about as small as possible and still be living, these two forms of life still possess the millions of atomic parts necessary to carry out the biochemical functions required for life, yet they still are too simple to live on their own and thus must use the cellular machinery of a host in order to live (Trefil, 1992, p. 28). Many of the smaller bacteria are not free living, but are parasite like viruses that can live only with the help of more complex organisms (Galtier et al., 1999).

The gap between non-life and the simplest cell is illustrated by what is believed to be the organism with the smallest known genome of any free living organism *Mycoplasma genitalium* (Fraser et al., 1995). *M. genitalium* is 200 nanometers long and contains only 482 genes or over 0.5 million base pairs which compares to 4,253 genes for *E. coli* (about 4,720,000 nucleotide base pairs), with each gene producing an enormously complex protein machine (Fraser et al., 1995). *M. genitalium* also must live off other life because they are too simple to live on their own. They invade reproductive tract cells and live as parasites on organelles that are far larger and more complicated but which must *first* exist for the survival of parasitic organisms to be possible. The first life therefore must be much more complex than *M. genitalium* even though it is estimated to manufacture about 600 different proteins. A typical eukaryote cell consists of an estimated 40,000 different protein molecules and is so complex that to acknowledge that the "cells exist at all is a marvel... even the simplest of the living cells is far more fascinating than any human- made object" (Alberts, 1992, pp. xii, xiv).

M. genitalium is one-fifth the size of *E. coli* but four times larger than the putative nanobacteria. Blood nanobacteria are only 50 nanometers long (which is smaller than some viruses), and possess a currently unknown number of genes. When Finnish biologist Olavi Kajander discovered nanobacteria in 1998, he called them a "bizarre new form of life." Nanobacteria now are speculated to resemble primitive life forms which presumably arose in the postulated chemical soup that existed when earth was young. Kajander concluded that nanobacteria may serve as a model for primordial life, and that their modern-day primordial soup is blood. Actually, nanobacteria cannot be the smallest form of life because they evidently are parasites and primordial life must be able to live independently. Like viruses they are not considered alive but are of intense medical interest because they may be one cause of kidney stones (Kajander and Ciftcioglu, 1998). Other researchers think these bacteria are only a degenerate form of larger bacteria.

For these reasons, when researching the minimum requirements needed to live the example of *E. coli* is more realistic. Most bacteria require several thousand genes to carry out the minimum functions necessary for life. Denton notes that even though the tiniest bacterial cells are incredibly small, weighing under 10^{-12} grams, each bacterium is a

> veritable micro-miniaturized factory containing thousands of exquisitely designed pieces of intricate molecular machinery, made up altogether of one hundred thousand million atoms, far more complicated than any machine built by man and absolutely without parallel in the non-living world (Denton, 1986, p. 250).

The simplest form of life requires millions of parts at the atomic level, and the higher life forms require trillions. Furthermore, the many macromolecules necessary for life are constructed of even smaller parts called elements. That life requires a certain minimum number of parts is well documented; the only debate now is *how many* millions of functionally integrated parts are necessary. The minimum number may not produce an organism that can survive long enough to effectively reproduce. Schopf notes that simple life without complex repair systems to fix damaged genes and their protein products stand little chance of surviving. When a mutation occurs

> cells like those of humans with two copies of each gene can often get by with one healthy version. But a mutation can be deadly if it occurs in an organism with only a single copy of its genes, like many primitive forms of life.... (Schopf, 1999, p. 102)

Therefore, the answer to our original question, "What is the smallest form of nonparasitic life?" probably is an organism close to size and complexity of *E. Coli*, possibly even larger. No answer is currently possible because we have much to learn about what is required for life. As researchers discover new exotic "life" forms thriving in rocks, ice, acid, boiling water and other extreme environments, they are finding the biological world to be much more complex than assumed merely a decade ago. The oceans now are known to be teeming with microscopic cells which form the base of the food chain on which fish and other larger animals depend. It now is estimated that small, free-living aquatic bacteria make up about *one-half* of the entire biomass of the oceans (MacAyeal, 1995).

Many highly complex animals appear very early in the fossil record and many "simple" animals thrive today. The earliest fossils known, which are believed to be those of cyanobacteria, are quite similar structurally and biochemically to bacteria living today. Yet it is claimed they thrived almost as soon as earth formed (Schopf, 1993; Galtier et al., 1999). Estimated at 3.5 billion years old, these earliest known forms of life are incredibly complex. Furthermore, remarkably diverse types of animals existed very early in earth history and no less than eleven different species have been found so far. A concern Corliss raises is "why after such rapid diversification did these microorganisms remain essentially unchanged for the next 3.465 billion years? Such stasis, common in biology, is puzzling" (1993, p. 2). *E. coli,* as far as we can tell, is the same today as in the fossil record.

Probability Arguments

As Coppedge (1973) notes, even 1) postulating a primordial sea with every single component necessary for life, 2) speeding up the bonding rate so as to form different chemical combinations a trillion times more rapidly than hypothesized to have occurred, 3) allowing for a 4.6 billion- year-old earth and 4) using all atoms on the earth still leaves the probability of a single protein molecule being arranged by chance is 1 in 10,261. Using the lowest estimate made before the discoveries of the past two decades raised the number several fold. Coppedge estimates the probability of 1 in $10^{119,879}$ is necessary to obtain the minimum set of the required estimate of 239 protein molecules for the smallest theoretical life form.

At this rate he estimates it would require $10^{119,831}$ years on the average to obtain a set of these proteins by naturalistic evolution (1973, pp. 110, 114). The number he obtained is $10^{119,831}$ greater than the current estimate for the age of the earth (4.6 billion years). In other words, this event is outside the range of probability. Natural selection cannot occur until an organism exists and is able to reproduce which requires that the first complex life form first exist as a functioning unit.

In spite of the overwhelming empirical and probabilistic evidence that life could not originate by natural processes, evolutionists possess an unwavering belief that some day they will have an answer to how life could spontaneously generate. Nobel laureate Christian de Duve (1995) argues that life is the product of law-driven chemical steps, each one of which must have been highly probable in the right circumstances. This reliance upon an unknown "law" favoring life has been postulated to replace the view that life's origin was a freakish accident unlikely to occur anywhere, is now popular. Chance is now out of favor in part because it has become clear that even the simplest conceivable life form (still much simpler than any actual organism) would have to be so complex that accidental self-assembly would be nothing short of miraculous even in two billion years (Spetner, 1997). Furthermore, natural selection cannot operate until biological reproducing units exist. This hoped for "law," though, has no basis in fact nor does it even have a theoretical basis. It is a nebulous concept which results from a determination to continue the quest for a naturalistic explanation of life. In the words of Horgan:

> One day, he [Stanley Miller] vowed, scientists would discover the self-replicating molecule that had triggered the great saga of evolution....[and] the discovery of the first genetic material [will] legitimize Millers's field. "It would take off like a rocket," Miller muttered through clenched teeth. Would such a discovery be immediately self-apparent? Miller nodded. "It will be in the nature of something that will make you say, 'Jesus, there it is. How could you have overlooked this for so long?' And everybody will be totally convinced" (Horgan, 1996, p. 139).

The atheistic world view requires abiogenesis; therefore scientists must try to deal with the probability arguments. The most common approach is similar to the attempt by Stenger, who does not refute the argument but tries to explain it by way analogy:

> For example, every human being on Earth is the product of a highly elaborate combination of genes that would be a very unlikely outcome of a random toss. Think of what an unlikely being you are—the result of so many chance encounters between your male and female ancestors. What if your great great great grandmother had not survived that childhood illness? What if your grandfather had been killed by a stray bullet in a war, before he met your grandmother? Despite all those contingencies, you still exist. And if you ask, *after the fact*, what is the probability for your particular set of genes existing, the answer is one hundred percent. Certainty! (1998, p. 9).

The major problem with this argument, as shown by Dembski, is that it is a gross misuse of statistics, one of the most important tools science has ever developed. Although change is involved, intelligence is critically important even in the events Stenger describes. The fallacy of his reasoning can be illustrated by comparing it to a court case using DNA. Stenger's analogy cannot negate the finding that the likelihood is 1 in 100 million that a blood sample found on the victim at the crime is the suspect's. For this reason, it is highly probable that the accused was at the crime scene; the fact that his blood was mixed with the victim's, will no doubt be accepted by the court and an attempt to destroy this conclusion by use of an analogy such as Stenger's will likely be rejected.

Conclusions

It appears that the field of molecular biology will falsify Darwinism. An estimated 100,000 different proteins are used to construct humans alone. Furthermore, one million species are known, and as many as 10 million may exist. Although many proteins are used in most life forms, as many as *100 million or more protein variations* may exist in all plant and animal life. According to Asimov:

> Now, almost each of all the thousands of reactions in the body is catalyzed by a specific enzyme ... a different one in each case ... and every enzyme is a protein, a *different* protein. The human body is not alone in having thousands of different enzymes—so does every other species of creature. Many of the reactions that take place in human cells also happen in the cells of other creatures. Some of the reactions, indeed, are universal, in that they take place in all cells of every type. This means that an enzyme capable of catalyzing a particular reaction may be present in the cells of wolves, octopi, moss, and bacteria, as well as in our own cells. And yet each of these enzymes, capable though it is of catalyzing one particular reaction, is characteristic of its own species. They may all be distinguished from one another. It follows that every species of creature has thousands of enzymes and that all those enzymes may be different. Since there are over a million different species on earth, it may be possible—judging from the enzymes alone—that different proteins exist by the millions! (Asimov, 1962, pp. 27–28).

Even using an unrealistically low estimate of 1,000 steps required to "evolve" the average protein (if this were possible) implies that many *trillions* of links were needed to evolve the proteins that once existed or that exist today. And *not one* clear transitional protein that is morphologically and chemically in between the ancient and modern form of the protein has been convincingly demonstrated. The same problem exists with fats, nucleic acids, carbohydrates and the other compounds that are produced by, and necessary for, life.

Scientists have yet to discover a single molecule that has "learned to make copies of itself" (Simpson, 1999, p. 26). Many scientists seem to be oblivious of this fact because

> Articles appearing regularly in scientific journals claim to have generated self-replicating peptides or RNA strands, but they fail to provide a natural source for their compounds or an explanation for what fuels them... this top-down approach... [is like] a caveman coming across a modern car and trying to figure out how to make it. "It would be like taking the engine out of the car, starting it up, and trying to see how that engine works" (Simpson, 1999, p.26).

Some bacteria, specifically phototrophs and lithotrophs, contain all the metabolic machinery necessary to construct most of their growth factors (amino acids, vitamins, purines and pyrimidines) from raw materials (usually O_2, light, a carbon source, nitrogen, phosphorus, sulfur and a dozen or so trace minerals). They can live in an environment with few needs but first must possess the complex functional metabolic machinery necessary to produce the compounds needed to live from a few types of raw materials. This requires more metabolic machinery in order to manufacture the many needed organic compounds necessary for life. Evolution was much more plausible when life was believed to be a relatively simple material similar to, in Haeckel's words, the "transparent viscous albumin that surrounds the yolk in the hen's egg" which evolved into all life today. Haeckel taught the process occurred as follows:

> By far the greater part of the plasm that comes under investigation as active living matter in organisms is metaplasm, or secondary plasm, the originally homogeneous substance of which has acquired definite structures by phyletic differentiations in the course of millions of years (1905, p.126).

Abiogenesis is only one area of research which illustrates that the naturalistic origin of life hypothesis has become less and less probable as molecular biology has progressed, and is now at the point that its plausibility appears outside the realm of probability. Numerous origin-of-life researchers, have lamented the fact that molecular biology during the past half-a-century has not been very kind to *any* naturalistic origin-of-life theory. Perhaps this explains why researchers now are speculating that other events such as panspermia or an undiscovered "life law" are more probable than all existing terrestrial abiogenesis theories, and can better deal with the many seemingly insurmountable problems of abiogenesis.

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Editor's Note

The *Quarterly* has published numerous items on the same subject as Dr. Bergman's article. Readers should find the following references of interest.

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