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Life on Earth Came From Other Planets

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ABSTRACT

A comprehensive theory based on a review of scientific findings published in prestigious scientific journals, is presented to explain how life on Earth came from other planets. Life appeared a few hundred million years after the Earth's creation during a period of heavy bombardment. Life on Mars may have appeared near the same time. Microbes are adapted for surviving the hazards of space, including ejection from and landing upon a planet. Microbial fossils have been discovered in fifteen carbonaceous chondrites, most impacted by supernova. The Sun and Earth were created from a nebular cloud and protoplanetary disc, the remnants of an exploding star and its planets which may have harbored life. When the parent star became a red giant, its solar winds blew away planetary atmospheres along with airborne microbes, which were deposited in a growing nebular cloud. Because the red giant lost 40% to 80% of its mass and its gravitational influences were reduced, its planets increased orbital distances or were ejected prior to supernova and may not have been atomized. The inner layers of a nebular cloud and protoplanetary disk protects against radiation and extreme cold enabling spores to survive. Microbes may have also survived within planetary debris which bombarded the Earth. As only life can produce life, then life on Earth also came from life which may have originated on planets which orbited the parent star.

Key Words: Panspermia; Origin of life; Abiogenesis, Supernova; Meteors, microfossils

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1. Introduction

"Very tiny animals result from the corruption of mortal things, arise from defects of dead bodies, or from excrements, or from putrefaction of dead bodies." -St. Augustine, Catholic Bishop, Church Father, Catholic Saint.

The origin of life is unknown, though speculation abounds. For thousands of years philosophers, scientists, and theologians have argued that Earthly life comes from non-life. This belief has been part of Catholic Church dogma since the 4th century (Augustine, 1957). Although known by many names (e.g. vitalism, spontaneous generation, the organic soup, abiogenesis), claims as to the abiogenic origins of Earthly life are based on belief in super natural forces and are firmly rooted in the Jewish-Christian Bible, Genesis, Chapter 1: "And God said, Let the earth bring forth the living creature after his kind, cattle, and creeping thing, and beast of the earth after his kind: and it was so." Thus, according to the early Church Fathers, god gave the Earth special life giving powers for spontaneously generating plants and animals: "The earth is said then to have produced grass and trees causaly, that is, to have received the power of producing" (Augustine, 1957).

Although popular newspapers and magazines (e.g. Scientific American, 2009) unabashedly and religiously promote an Earth-based abiogenesis, no one has demonstrated or proved that life can be produced from non-life. "Abiogenesis" is not even a true scientific theory, but should instead be considered a speculative hypothesis devoid of fact-based scientific support. Even the hypothesis of an Earthly "RNA World" where the first living things are said to have had an RNA-based genome (Woese 1968), is fatally flawed, as demonstrated by the reproductive strategy of viruses, whose RNA-based genomes require the DNA of a living host. By contrast, the maxim: only life can produce life, has never been discredited.

Certainly, if given billions of years of time where all the essential ingredients and conditions are present, it is possible life may have begun in a nebular cloud or on an ancient world whose chemistry is different from Earth (Joseph and Schild 2010a,b). However, there is no evidence to support the belief that life on Earth originated from non-life. Given the complexity of a single-celled organism and its DNA, the likelihood that life on Earth began in an organic soup is the equivalent of discovering a computer on Mars and claiming it was randomly assembled in the methane sea.

Therefore, life on Earth must have also originated from life which arrived her from other planets, and this theory is supported by considerable evidence reviewed here, and in companion papers which details the genetic evidence (Joseph 2009; Joseph and Schild 2010b; see also Sharov, 2006, 2009). This does not mean to argue that life has no origins. In an infinite universe and given infinite opportunities and infinite combinations of the necessary ingredients, it can be concluded that life may have arisen more than once and in more than one location long before the creation of Earth, our solar system, or this galaxy (Joseph 2010; Joseph and Schild 2010a,b). The descendants of these life forms were dispersed throughout the cosmos via panspermia, and eventually fell to Earth.

"Panspermia" the theory that life on Earth came from space, comets, or other planets, has an ancient history (Curd 2007), and has been championed by esteemed scientists including Lord Kelvin (Thomson 1881), von Helmholtz (1872), Sir Fred Hoyle and Chandra Wickramasinghe (Hoyle & Wickramasinghe 1993, 2000), and Nobel Laureates Svante Arrhenius (1908) and Francis Crick (1981).

Arrhenius proposed that spores journey through space propelled by photons. Hoyle and Wickramasinghe have identified comets and cosmic dust as a likely life delivery source. Crick theorized that highly intelligent extra-terrestrial life evolved on a planet much older than our own, and proposed purposeful contamination which he termed "directed panspermia."

In a series of published video lectures which have been viewed online (in total) millions of times, and in a series of scientific articles published by this author and colleagues (Joseph 2000, 2008, 2009a,b, 2010; Joseph and Schild 2010a,b; Joseph and Wickramasinghe 2010) it has been proposed that living creatures arrived on Earth contained in comets, asteroids, and planetary debris, the remnants of planets shattered by a supernova. There is in fact evidence that Earth is a remnant from another solar system, a rogue planet which was ejected prior to supernova (Joseph and Schild 2010a). If correct, then microbial life may have been present in and on this planet long before the birth of our solar system and may have subsequently been seeded with additional life beginning over 4.5 billion years ago.

Microbes can form spores, become dormant and are adapted for surviving the hazards of space (Horneck et al. 2002; McLean and McLean 2010; Nickerson et al., 2004; Nicholson et al. 2000; Osman et al., 2008; Szewczyk et al., 2005; Wilson et al., 2007), and spores can return to life even after hundreds of millions of years (Vreeland et al. 2000). Microfossils and evidence of past microbial life have been detected in fifteen carbonaceous chondrites (discussed in section 11) which originated outside this solar system, and possibly on other planets. Most have been impacted by supernova. Thus, it is proposed that when planets were ejected from solar systems during the red giant phase prior to supernova, and debris produced during supernova contained living spores, and some of this material fell to Earth and helped to form this planet, which in turn may have long ago been ejected from a dying solar system.

Independent studies have provided evidence indicating life may have been present on Earth, fractionating and synthesizing carbon, throughout the Hadean eon, during the periods of heavy bombardment, which extends from 3.8 billion years (BY) to the creation of this planet 4.6 BY ago.

In 1978, the presence of microfosils resembling yeast cells and fungi, was discovered in 3.8 BY old quartz, recovered from Isua, S. W. Greenland (Pflug 1978). Further evidence of biological including photosynthesizing activity in these ancient rock formations is indicated by the high carbon contents of the protolith shale, and the ratio of carbon isotopes in graphite from metamorphosed sediments dating to the same period (Rosing, 1999, Rosing and Frei, 2004).

Carbon-isotope evidence for life has also been found in Quartz-pyroxene rocks on Akilia, West Greenland dated to 3.8 BY (Manning et al. 2006; Mojzsis et al. 1996). Some of this evidence was discovered within a phosphate mineral, apatite, which included tiny grains of calcium and high levels of organic carbon; the residue of photosynthesis, oxygen secretion, and thus biological activity.

These "biological fingerprints" from 3.8 BY were created during a period known as the "Late Heavy Bombardment" (Schoenberg et al. 2002) when the Earth, the moon, and other planets were pummeled with debris that may have harbored complex life.

However, that bombardment began following the creation of this solar system, causing the surface of the Earth to melt and form new rocky layers. Thus additional evidence for life has been discovered in the planet's oldest rocks, i.e. those which formed during the early bombardment phase. These include the discovery of banded iron formations in northern Quebec, Canada, consisting of alternating magnetite and quartz dated to 4.28 BY, and which may be associated with biological activity (O'Neil et al. 2008). In addition, microprobe analyses of the carbon isotope composition of metasediments in Western Australia formed 4.2 BY revealed very high concentrations of carbon 12, or "light carbon" which is typically associated with microbial life (Nemchin et al. 2008).

Moreover, microfossils have been discovered in ALH84001, a meteor from Mars (McKay et al 1996) variably dated from 4.5 BY (Jagoutz, 1994; Nyquist et al., 1995) to 4.0 BY (Ash et al. 1996) to 3.8 BY (Wadhwa and Lugmair 1996). This is a time period when both planets were undergoing a heavy bombardment (Ash et al., 1996; Schoenberg et al. 2002).

Life may have been present from the very beginning when the Earth was being pounded by stellar debris. As only life can create life, this indicates that life on Earth may have arrived within that debris. Thus, life on Earth came from other planets.

2. Red Giants, Supernova & the Dispersal of Life

It is generally believed that our sun was created within a nebular cloud produced by a supernova nearly 5 billion years ago. According to conventional wisdom, a protoplanetary disc formed from the remnants of the nebular cloud surrounding the new sun, thereby giving rise to the planets of this solar system (Greaves 2005; van Dishoeck 2006). However, these planets, including Earth, may have been remnants, or even rogue planets, ejected from the dying solar system prior to supernova.

Microbes which took up residence on Earth during the Hadean period also have as their likely source the parent star and its planets. These microbes may have been dispersed in two stages.

Using our own solar system as an example (Schroder & Smith 2008) when the parent star became a red giant, the accelerating power of its solar winds would have blown away the life-sustaining atmospheres of its planets which included airborne microbes, creating a nebular cloud at the far edges of the dying solar system.

The parent star may have lost between 40% to 80% of its mass before exploding (Kalirai, et al. 2007; Liebert et al. 2005; Wachter et al. 2008) and its planets would have significantly increased their orbital distances and may have been ejected from its solar system prior to supernova. Thus the supernova may have shattered but probably did not atomize all its planets. What would become Earth, therefore, may have originated as an expelled planet which came to reside in that nebular cloud. And deep within this debris which became part of the nebular cloud, innumerable microbes may have continued to flourish.

3. Red Giant, Solar Wind, & Wind Borne Microbes

Distinct species of over 1,8000 different types of bacteria and other microbes thrive and flourish within the troposphere, the first layer of the Earth's atmosphere (Brodie et al. 2007). Air is an ideal transport mechanism and serves as a major pathway for the dispersal of bacteria, virus particles, algae, protozoa, lichens, and fungi including those which dwell in soil and water. Microorganisms and spores have been recovered at heights of 40 km (Soffen 1965), 61 km (Wainwright et al., 2010) and up to 77-km (Imshenetsky, 1978). These include Mycobacterium and Micrococcus, and fungi Aspergillus niger, Circinella muscae, and Penicillium notatum 77-km above the surface of Earth (Imshenetsky, 1978). Moreover, due to tropical storms, monsoons, and even seasonal upwellings of columns of air (Randel et al., 1998), microbes, spores, fungi, along with water, methane, and other gases may be transported to the stratosphere. Hence, it can be readily assumed that microbes not only flourish in the troposphere, but are commonly lofted into the stratosphere (Wainwright et al., 2010).

Between September 22- 25, 1998, and as detected and measured by NASA's Ultraviolet Imager aboard the Polar spacecraft, a series of coronal mass ejections (CME) and a powerful solar solar wind created a shock wave which struck the magnetosphere and the polar regions with sufficient force to cause oxygen, helium, hydrogen, and other gases to gush from the Earth's upper atmosphere into space (Moore and Horwitz, 1998). Normally the pressure is around 2 or 3 nanopascals. However, when the CME struck on Sept. 24, the pressure jumped to 10 nanopascals. Thus it could be predicted that some airborne microbes may have also been swept away.

Normally, such creatures might be too heavy to be lofted into space. But under red giant conditions, it can be predicted that the solar wind would strike with sufficient force to strip away atmosphere, water molecules, surface dust (Schroder & Smith, 2008), along with air-born bacteria, spores, fungi, lichens, algae, and other microbes.

As the parent star entered the red giant phase, the outer layer would have increased in size and the sun would lose mass at an accelerated rate, swept away by an increasingly dense and clumpy solar wind which streamed into space and buffeted its planets. The wind was likely accompanied by Alfven waves which interacted with, heated, and accelerated the solar wind (Suzuki 2007).

A nebular cloud would form from the ejecta, the inner layers (facing the remnant heat from the supernova) would be warmer than the outer layers (see discussion: Ehrenfreund and Menten 2002; Jansen et al., 1994; Yamamato 1985; Yurimoto and Kuramoto 2004). Nebular clouds, along dust particles, would also provide protection against radiation (Clayton, 2002; Flanner et al., 1980; Herbst and Klemperer 1973; Nishi et al., 1991; Prasad, and Tarafdar 1983). As based on related studies (Horneck et al. 2001a, b, 2002, 1994; Mitchell and Ellis 1971; Nicholson et al 2000), spores would likely survive under these conditions.

Water and a wide array of organics have been detected in nebular clouds including polycyclic aromatic hydrocarbons and possibly the amino glycine (Ehrenfreund and Menten 2002; Ehrenfreund and Sephton 2006; Gomez et al. 2008; Kaiser 2002; Schutte 2002; Snyder, 2004; Stochel et al., 2009). Some of this material is abiotic and may have been produced within the molecular cloud. However, some of the organic molecules are larger than would be expected given the low range of temperatures and pressures within these clouds. Thus, the large organics may be biological and evidence of life such as that dispersed by pre-supernova solar winds. These findings also strengthens the possibility that life may have originated in, or currently dwells in nebular clouds.

4. Microbes Are Preadapated for a Journey In Space

Many species of microbe have evolved the ability to survive a violent hypervelocity impact and extreme acceleration and ejection into space including extreme shock pressures of 100 GPa; the frigid temperatures and vacuum of an interstellar environment; the UV rays, cosmic rays, gamma rays, and ionizing radiation they would encounter; and the descent through the atmosphere and the landing onto the surface of a planet (Burchell et al. 2004; Burchella et al. 2001; Horneck et al. 2001a.b, Horneck et al. 1994; Mastrapaa et al. 2001; Nicholson et al. 2000, 2004; Mitchell and Ellis 1971). For example, a single dormant microbe was recovered from a lunar camera which had set on the moon for 3 years and completely exposed to radiation and freezing and broiling temperatures (Mitchell and Ellis 1971), whereas viable organisms, including the nematode, *Caenorhabditis elegans* (Szewczyk et al., 2005) and Microbispora sp (McLean et al., 2006) survived the explosion and reentry of the space Shuttle Columbia in 2003. In fact, under space-flight conditions of microgravity, viability may even increase and microorganisms can actually thrive (Nickerson et al., 2004; Wilson et al., 2007).

As will be detailed in Section 8 microbes are preadapted for traveling through space and living in almost every conceivable environment (Section 7), and it can be assumed they would not have evolved these capabilities if their entire ancestral and genetic history had been confined to Earth and the conditions of this world.

5. Low Mass Parent Star: Implications for Life

Given the paucity of evidence for nearby stars the same age as the sun, it could be assumed only a few protostars may have been produced by the supernova of the parent star. Thus, the parent star may have been only a few solar masses larger than the sun. This assumption is supported by isotopic analysis of the Murchison meteorite which is laden with microfossils and other indices of life (Section 11).

Measuments of silicon carbide (Werner et al. 1994; Nittler & Hoppe 2005) and presolar SiC grains (Savina et al. 2003) from the Murchison indicates that the grains and silicon are most likely the residue of or were produced secondary to a supernova. Supernova also impacted a number of other carbonaceous chondrites (Birck, 2004) which contain microfossils, including the Orgueil (Jadhav et al. 2006, 2007; Jadhava et al. 2006), Allende (Elgoresy and Ramdohr, 1980), Efremovka, and Ivuna (Shukolyukov and Lugmaira, 2006).

An analysis of ubiquitous of FE and NI carbides in the rims of magnetite and the carbide grains within the Murchison (Brearly 2003) indicates oxidation within the parent body of the meteor, which could have been a much larger body such as a planet or planetesimal (Ehrenfreund et al. 2001). An analysis of the presolar SiC grains and other isotopes, indicates it was impacted by the supernova of a carbon rich intermediate mass star that was between 1.5 to 3 solar masses (Savina et al. 2003).

Planets have been detected orbiting intermediate mass stars (Lovis and Mayor 2007). Thus, the Murchison and the other carbonaceous chondrites impacted by supernova, may be a remnant of the parent star's solar system, though this can't be determined at this time.

As only the estimated mass of that star is available and there is no information on nearby stars at the time of supernova, a Hertzsprung-Russell diagram cannot be applied to determine the age of the parent star at the time of supernova. However, based on the estimated ages and lifetimes of other intermediate mass stars (Pillitteri and Favata 2008) it can be estimated that a parent star of between 1.5 and 3 solar masses, was at least 1 billion to 3 billion years in age before it entered the red giant phase. Using the Earth as an example, this is enough time for microbial life to flourish on its planets, and for more complex life forms to begin to evolve.

6. Red Giants, Supernova & Rogue Planets

The surface temperature of a red giant prior to supernova is much lower than that of our sun. For example, although over 2000 times as large, VY Canis Majoris is only 3,500 K, compared with the 5,778 K of our sun (Monnier et al. 1999; Wittkowski et al. 1998). It is unlikely an intermediate mass star which becomes a red giant would have a surface temperature greater than our sun. Therefore, microbes living on planets circling at a sufficient distance would not be unduly heated, particularly as these planets would have increased their distance from the central star as it lost mass and expanded in size.

The kinetic energy of an orbiting planet is half the energy of its escape velocity. Planets as well as the central star exert gravitational effects on one another (Gladman 2005). A star loses from 40% to 80% of its mass during the red giant phase (Kalirai et al. 2007; Liebert et al. 2005; Wachter et al. 2008). Therefore its gravitational influences would be lessened. Thus, planets that had occupied an Earth-like habitable zone would have begun to increase their distance from the parent star as it lost mass and expanded in size (Schroder and Smith 2008). If these planets were larger than the Earth (and depending on other parameters) they would likely be expelled from the solar system prior to supernova (Schroder and Smith 2008).

One planet, having a mass 4.2 times that of the Earth, has been detected orbiting a main sequence star, HD 40307, located 42 light-years away towards the southern Doradus and Pictor constellations (Mayor et al. 2009). Another, planet having a mass 5 times and a radius 1.5 times that of the Earth was discovered orbiting the "habitable zone" of Gliese 581 in the constellation Libra, and with an estimated surface temperature between 0 C and 40 C (Udry et al. 2007)--a temperature range amenable to even complex creatures.

As these "super Earths" appear to be common (Mayor et al. 2009), similar "super Earths" may have orbited the parent star, but may have been expelled prior to supernova and during the early red giant phases. Thus, when the parent star exploded, although some of its planets may have been shattered, it is unlikely they would have been atomized if they had been ejected.

Consider again the Murchison. An analysis of the isotopic composition of silicon carbide grains, indicates impact by shock waves from a supernova of a star which has lost almost all of its hydrogen mass (Pellin et al. 2002), indicating its gravitational influences were significantly reduced. These findings, coupled with results from shock-recovery experiments performed on insoluble organic matter within the Murchison (Mimura et al. 2007) are also consistent with the proposal that its parent body was expelled from the solar system prior to supernova, and was then impacted following supernova, perhaps while drifting within a planetary nebula.

7. Life Thrives in Extreme Environments

Habitable planets which are expelled and shattered might continue to harbor life. Communities of hyperthermophiles have been recovered from geothermally heated rocks 2,500 to 3500 meters beneath the surface of the Earth (Boone et al. 1995; Setter 2002), and aside 400 C rock chimneys at depths of 4000 meters (Setter 2002), at the bottom of the ocean where pressures are 9000 pounds per square inch.

Baccilus infernus, thrives at depths of 2,700 meters where the weight and pressure is 300 x that of the surface and where temperatures may exceed 117 C (Boone et al. 1995). Hyperthermophiles continue growing even in 100 C boiling water (Setter 2002) and they can survive without oxygen (Setter 2002), liberating chemicals and minerals for energy.

Microorganisms have also been recovered from cores 400 meters deep in the Canadian arctic (Gilinchinsky 2002). Viable cells dated to 3 million years have been recovered in northeast Siberia. According to Gilinchinsky (2002) "The permafrost can maintain life incomparably longer than any other known habitats" and "contain a total microbial biomass many times higher than that of the soil." "The permafrost community have overcome the combined action of extremely cold temperature, desiccation, and starvation" and "life might be preserved in permafrost conditions for billions years."

It can be predicted that a substantial number of microbes such as those normally dwelling deep beneath the surface, near volcanic substrates, or frozen within the ice, could easily survive if the host planet were shattered or ejected from the solar system, and would do so under localized conditions little different from those prior to a supernova.

8. Radiation Resistance Microbes

The shock wave of a supernova would accelerate electrons, protons, and ions and heat the interstellar medium. Incredible amounts of energy would be released in the form of radioactive isotopes, free electrons, X-rays and gamma rays. However, a significant number of microbes would be unaffected.

When subjected to life neutralizing conditions, microbes and other single celled creatures can form spores and become dormant. Further, a spore can form a highly mineralized core enclosed in heat or cold shock proteins which wrap around and protect them (Marquis and Shin 2006). They will also saturate their DNA with acid soluable proteins which alters the enzymatic and chemical reactivity of its genome making it nearly impermeable to harm (Setlow and Setlow 1995).

"In the dormant stage a spore has no metabolism and resists cycles of extreme heat and cold, extreme desiccation including vacuuum, UV and ionizing radiation, oxyidzing agents and corrosive chemicals" (Nicholson et al. 2000). Space experiments and the Long Duation Exposure Facility Mission have shown that bacteria and fungal spores can easily survive the vacuum of space and constant exposure to solar, UV, and cosmic radiation with just minimal protection (Horneck 1993; Horneck et al.1995; Mitchell and Ellis, 1971). However, survival rates increase significantly from between 30% to 70% if coated with dust, or embedded in salt or sugar crystals (Horneck et al. 1994). In fact, on Earth, bacterial spores embedded in salt crystals dated to 250 million years (Satterfield et al. 2005), survived and were brought back to life (Vreeland, et al. 2000).

Viable cells lofted into the vacuum of space in the absence of a protective environment would also react to the absence of water in space by becoming "freeze dried" and dormant (Setlow, 2006). Under these conditions these microbes develop heightened resistance to radiation and extremes in temperature (Sunde et al., 2009).

Not just spores, but lichens, fungi and algae survive exposure to massive UV and cosmic radiation and the vacuum of space (Sancho et al. 2005). Lichens show nearly the same photosynthetic activity before and after space flight, and multimicroscopy investigation revealed no detectable ultrastructural changes in most of the algae and fungal cells (Sancho et al. 2005).

Microffosils resembling fungi were discovered in 3.8 million year old quartz, recovered from S. W. Greenland (Pflug 1978); a time period corresponding to the "late heavy bombardment." And vast colonies of algae were building stromatolites by 3.5 billion years ago. Thus, these fungi and algae could have survived a journey through space and may have been deposited on the Earth.

Although the full spectrum of UV rays is deadly against spores, the likelihood of a direct hit, even if unprotected while traveling through space is unlikely. Moreover, just a few meters of surface material offers more than sufficient protection for those buried deep inside (Horneck et al. 2002).

Microbes were recovered from a camera that had sat on the moon for nearly 33 months, directly exposed to the vacuum of space, constant radiation, an average temperature of 20 degrees above absolute zero, and without nutrients, water or energy source (Mitchell and Ellis, 1971). When brought back to Earth they recovered and began to reproduce.

High-energy radiation or particles from extraterrestrial space (HZE) that strike a meteor, asteroid, comet, or lunar camera, may create secondary radiation. Studies have shown that as the thickness of surrounding material increases beyond 30 cm, the dose rate and lethal effects of heavy ions, including secondary radiation, depreciates significantly (Horneck et al. 2002). B. subtilis spores can survive a direct hit even though HZE particles can penetrate thick shielding (Horneck et al. 2002).

Moreover, many species of microbe can withstand X-rays and atomic radiation, and are radiation resistant. These include Deinococcus radiodurans, D. proteolyticus, D. radiopugnans, D. radiophilus, D. grandis, D. indicus, D. frigens, D. saxicola, D. marmola, D. geothermalis, D. murrayi. These species can rebuild their genomes even if shattered by radiation (Lovett, 2006) and the same is true of yeast (Scheifele and Boeke 2008).

Microbes and spores are so small that even when bombarded with photons and deadly gamma and UV rays the likelihood they would be struck is infestimally minute. Estimates are that a spore may exist in space for up to a million years in space before it may be struck (Horneck et al. 2002). Even after 25 million years in space, a substantial number of spores would survive if shielded by 2 meters of meteorite (Horneck et al. 2002).

Likewise, those microbes, algae, fungi, and lichens dispatched from the surface of their home planets by an increasingly powerful solar wind prior to supernova, and which became part of the growing nebular debris field, would have been protected. The central layers of a molecular cloud shields against deadly gamma and cosmic rays which are deflected by dust, ice and debris (Clayton, 2002; Ehrenfreund and Menten 2002; Herbst and Klemperer 1973; Nishi et al., 1991; Prasad, and Tarafdar 1983), and are sufficiently warm that ice evaporates (van Dishoeck 2006).

Further, many species of bacteria and microbes form colonies. Those on the outer layers, if killed, create a protective crust, blocking out radiation and protecting those in the inner layers from the other hazards of space (Nicholson et al. 2000). Therefore, be they buried within rock, ice, or some other stellar material, colonies of living microbes could provide their own protection.

Clearly, these extraordinary life-sustaining capabilities were acquired after repeated and prolonged ancestral experiences within an interstellar environment involving journeys through space and from planet to planet. Microbes are perfectly adapted for a life in space and could not have evolved these capabilities if their entire ancestral and genetic history had been confined to a life on Earth.

9. Planet Formation, Rogue Worlds, & Spore Survival

A supernova creates tremendous shock waves, shattering its planets, and expelling most of the star and remaining planetary debris into the surrounding interstellar medium. This debris eventually becomes part of the surrounding nebular ring created by the solar winds, planetary atmospheres, and expelled mass of the dead star (Greaves 2005, van Dishoeck 2006).

Over hundreds of thousands of years and in response to cosmic shock waves and radiant energy produced perhaps by nearby exploding stars, the debris within these clouds begins to clump together, generating tremendous amounts of energy as they grow larger and denser and become enveloped by hydrogen gas. Add to this the influences of Quasars and black holes which direct streams of hydrogen gases into nebular clouds and which appear to envelop these super-hydrogen gas giants (Joseph and Schild 2010a). Therefore, as these proto-stars grow an ever denser hydrogen atmosphere, they finally ignite, such that dozens, hundreds, even thousands of proto-stars may be created (Hester et al. 2004). According to the most conservative estimates it could take a hundred million years for a new sun to form (Montmerle et al. 2006). These young stars are surrounded by a debris field, perhaps containing planetary fragments or even rogue planets. The debris field eventually flattens and forms a protoplanetary disc.

The inner layers of a protoplanetary disc are not easily penetrated by UV photons, gamma and cosmic rays or radiation from the sun due to dust and debris (van Dishoeck 2006). The central and inner layers (facing the proto-star) provide a protective environment for microbial survivors, and are sufficiently warm (Glassgold et al., 2004; Kamp and Dullemond 2004) that ice evaporates and water vapors form (Eisner 2007; van Dishoeck 2006).

Planet formation proceeds at a relatively rapid pace, from a few hundred years for a small rocky planet the size of the Earth to one million years for Jupiter and Saturn-sized gas giants (Kokubo and Ida 2002) depending on the initial disk mass. Computer models and observations of planet-formation have given us an understanding of the mechanisms (Kokubo and Ida 2002; Raymond et al. 2007). Within just a few thousand years the remnants of the supernova and the nebular cloud which surrounded the proto-sun, begin to flatten out into a swirling circular proto planetary disk. According to conventional wisdom, after just a few spins around the new proto-star, islands of debris begin to collide and clump together forming moon-like planets, increasing in size by accretion (Goldreich et al. 2004). However, the only way a planet can grow by accretion is if the *planet* was already quite large to begin with and then accumulated mountains of much smaller debris.

According to the most conservative estimates, if mechanisms of accretion are very slow, it could take up to a million years for a massive solid planetary core to form. Then it would quickly snow ball in size through clumping and as debris continued to crash into it (Montmerle et al. 2006).

Yet another explanation is that when a star supernovas, it ejects molten iron into these nebular clouds. Therefore, planets begin to form when debris comes into contact with and then sticks to the hot iron which becomes a planetary core (Joseph and Schild 2010a). Then there are those rogue planets which were ejected prior to supernova. Therefore, some solar systems may acquire fully formed or broken and shattered planets which grow by accretion after they are captured by the new proto-star.

Greaves et al. (2008) discovered a protoplanet which she reports (National Geographic, 2008) was created 2,000 years ago, circling a young star HL Tau, which is 100,000 years old. Could a planet form so quickly from debris crashing together?

It has been estimated that the core of the Earth was rapidly formed from chondrites and then underwent rapid accretion within 10 million years such that our planet was formed approximately 30 million years after the origin of our solar system (Jacobsen, 2005). Chondrites, however, are the remnants of other planets.

Planetary cores therefore, may be comprised of the remains of the shattered planets which had been expelled from the solar system of the parent star prior to supernova. However, entire planets would have also been ejected. This would explain why full formed planets were already crashing into each other during and soon after the formation of this solar system. Jacobsen (2005) estimates that within 30 million years after the formation of the solar system, Earth was struck by a Mars-sized planet.

These shattered and intact rogue planets could have harbored spores, microbes, viruses, bacteria, lichens, yeast, and algae. If correct, then it could be predicted that the descendants of microbes whose genomes are alien to the surface of our planet, and which were buried by accumulating stellar debris should be discovered miles beneath the Earth and below the subfloor of the ocean; and this prediction has been born out (Biddle et al., 2008; Chivian et al., 2008; Doerfert et al., 2009; Moser et al., 2005; Gohn et al., 2008; Hinrichs et al., 2006; Sahl et al., 2008). Consider for example, the bacterium, Desulforudis audaxviator, discovered 2.8-kilometers (1.74 miles) beneath the surface. Genomic analysis of its 2,157 protein-coding genes indicates this species "is capable of an independent life-style well suited to long-term isolation from the photosphere deep within Earth's crust and offers an example of a natural ecosystem that appears to have its biological component entirely encoded within a single genome (Chivian et al., 2008). The genome of D. audaxviator indicates it has never been exposed to sunlight, obtains its nourishment from non-biological sources, and can form spores.

The presence of species miles beneath the surface of our planet suggests they were deposited there, encased in planetary debris, as the Earth was formed. However, this would also imply that a smaller Earth was captured by this solar system and then grew by accretion.

Therefore, the core of every planet in our solar system may be comprised of the remains of the shattered planets which had been expelled from the solar system of the parent star prior to supernova. These shattered rogue planets could have harbored spores, microbes, viruses, bacteria, lichens, yeast, and algae.

Survival of these broken planets, and their presence within the protoplanetary disc would explain why Uranus, Mars, the Earth, and Mercury may have been struck by wayward worlds during the early years of solar system formation (Gladman 2005; Goldreich et al. 2004; Nimmo et al. 2008). For example, around 4 billion years ago, a Mars-sized planet may have hit the Earth with so much force that the ejected mass may have come to form the moon (Belbruno and Gott III 2005; Poitrasson et al. 2004, Rankenburg et al. 2006).

Around 4 billion years ago, the northern plains of Mars was gutted by a planet-sized body which left an elliptical depression 6,600 miles long and 4,000 miles wide (Andrews-Hanna et al. 2008). The planet Mercury may have also suffered a collision which left a titanic impact basin. Uranus was apparently struck so hard by an Earth-sized body that its rotation axis tilted sideways, nearly into the plane of its revolution about the Sun (Bergstralh et al. 1991).

Thus, there is considerable evidence that planet-sized objects were careening through the solar system during its early stages of formation and in directions and trajectories different from the other planets. It also appears that the sun and its planets had become established within a 100 million years.

A 100 million years is more than enough time for any surviving life forms contained in the remnants of the parent star's shattered planets or the nebular cloud or the protoplanetary disk to find safe harbor within a new world made up of this debris. Some microbes become dormant and can rewaken even after 250 million years (Vreeland et al. 2000). In fact "living bacteria" have been discovered and "isolated from salt deposits from the Middle Devonian, the Silurian, and the Precambrian" making some of them over 600 million years in age (Dombrowski 1963).

Thus microbes may survive from 250 million to 600 million years. However, only one microbe had to survive, and once on Earth could cover the planet in bacterial offspring within a few months.

10. Extraterrestrial Contamination of Earth by Microbes

Experiments have shown that microbes can survive the shock of a violent impact casting them deep into space (Mastrapaa et al. 2001; Burchell et al. 2004; Burchella et al. 2001). Further, a substantial number could easily survive the descent to the surface of a planet (Burchella et al. 2001; Horneck et al. 2002), even following high atmospheric explosions, i.e. the Columbia space shuttle explosion (Szewczyk et al., 2005) and rentry speeds of 9700 km h^{-1} (McLean et al., 2006).

When meteors strike the atmosphere, they are subjected to extremely high temperatures for only a few seconds. If of sufficient size, the interior of the meteor will stay relatively cool, with the surface material acting as a heat shield. Thus the heat does not effect the material uniformly. The interior may never be heated above 100 C (Horneck et al. 2002), whereas spores can survive post shock temperatures of over 250 C.

11. Meteors & Microfossils.

Microbial fossils have been found in fifteen carbonaceous chondrites including the Murchison (Claus and Nagy 1961; Hoover 1984, 1997; Pflug 1984), Ivuna (Claus & Nagy 1961), Orgueil [Hoover 2004; Nagy et al. 1961,1963a,b; Claus and Nagy 1961), Allende (Folk and Lynch 1997; Zhmur and Gerasimenko 1999), and Efremovka (Zhmur and Gerasimenko 1999; Zhmur et al. (1997). The fossilized impressions of nanobacteria, extremophiles, and colonies resembling cyanobacteria have been detected by several independent investigators and NASA scientists.

Organic material and biogenic hydrocarbons believed to have been produce by extraterrestrial creatures, and organized elements and cell structures that resemble fossilized algae were identified as indigenous to the Orgeuil (Claus & Nagy 1961; Nagy et al. 1962; Nagy et al. 1963a,b,c). Smooth filamentous and spherical skins surrounding grains of inorganic material were discovered, and many were doubled like the walls of biological cells. Some of the skins resembled microscopic fungi.

Further study of the Orgeuil and Ivuna meteorites using an electron probe and electron microscope, revealed the presence of microfossils (Nagy et al., 1962, 1963a,b), some of which were very similar to purple photosynthetizing bacteria belonging to the species Rhodopseudomonas rutilis (Pflug 1984). Additional confirmation was provided by Richard Hoover of NASA, who discovered, using NASA's Field Emission Scanning Electron Microscope, fossilized colonies resembling cyanobacteria (Hoover 1984). These fossils were found in a freshly fractured, interior slice of the Orgueil meteorite, making it almost impossible they are due to contamination.

Pflug (1984), discovered virus particles and clusters of an extensive array of microfossils within the Murchison meteorite, similar to terrestrial bacteria such as methanogens and Pedomicrobium, a flowering bacteria which feeds on metals. Pflug (1984) used acid to disolve the mineralized portions and identified numerous fossil like structures nearly identical to those found in ancient terrestrial rock and iron banded formations in Gunflint Minnesota -- these formation extend backwards in time to 4.2 bilion years ago.

These results were confirmed by Hoover (1997) who discovered fossiled bacteria deep within the Murchison meterorite which resemble colonies of living cyanobacteria. According to Dr. Hoover (1997), "the fossils were seen in freshly broken pieces of the meteorite so the chance that they were earthly contaminants is low. The chemical evidence around the microfossils is most readily explained as the result of biological activity."

As summed up by Dr Hoover (1997): "The Murchison forms represent an indigenous population of the preserved and altered carbonized remains (microfossils) of microorganisms that lived in the parent body of this meteorite at diverse times during the last 4.5 billion years."

Fossils of microoganisms, cynobacteria and coccoid bacteria similar to the Synechococcus genera were found inside the Efremovka meteorite (Zhmur and Gerasimenko 1999). Zhmur et al. (1997) conducted a "comparative analysis of bacteriomorphic structures from the carbonaceous meteorites Murchison, Efremovka, and Allenda" and the "morphology of microorganisms of modern and ancient cyanobacterial community." They concluded that fossils found on these three meteors are the "fossilized remnants of microorganisms. The lithified remnants are tightly conjugated with the mineral matrix, removing the possibility they are contaminants."

The Ivuna, Orgueil, Murchison, Allende, and Efremovka meteorites are all carbonaceous chondrites. Carbonaceous chondrites typically contain a high abundance of water-bearing minerals, organics and biologically related compounds (see e.g. Botta and Bada, 2002; Hoover 2006; Sephton 2002).

Numerous independent research groups have detected the nucleobases for DNA and RNA within carbonaceous chondrites, including adenine, guanine, uracil, as well as melamine (Hayatsu, 1964; Hayatsu et al. 1968, 1975; Hayatsu et al. 1968; Folsome et al. 1971,1973; Lawless et al. 1972; Van der Velden and Schwartz, 1977; Stoks and Schwartz 1979, 1981; Martins et al. 2008). These organics are extra-terrestrial in origin (Van der Velden and Schwartz 1977; Martins et al. 2008) and were most likely produced biologically (Hoover 2006). As only life can produce life, these are not pre-biotic.

Amino acids and nucleobases for DNA and RNA, including adenine, guanine, alanine, glyciine and isovaline were also discovered in the interior of the Orgeuil (Hayatsu 1964; Hayatsu et al. 1968; Folsome et al. (1971, 1973; Lawless et al. 1972). Carbon isotopic measurements demonstrated these acids were extraterrestrial and originated in an environment with water and a high concentration of organic carbon. Thus, they are likely biological in origin.

The presence of DNA and RNA fragments are also an indication of extraterrestrial life. The genomes of living creatures journeying through space, can be fractured and broken if struck by radiation (Dose et al. 1995). Thus many meteorities contain DNA nucleotides which may be the broken remnants of bacterial DNA.

The Murchison also contains an extensive array of organic compounds including nitrogen bases and over 70 different amino acids and a preponderance of left-handed aminos which are characteristic of life (Cooper et al. 2001; Cronin et al. 1993). These include guanylurea, triazines, aliphatic amines, a pyrimidine, and purines, e.g., adenine, guanine, uracil (Hayatsu et al. 1975; Folsome et al. 1971, 1973; Stoks and Schwartz, 1979, Van der Velden and Schwartz, 1977, Martins et al. 2008). Additional study found sugars, organic residue and vesicles that had formed organic compounds (Dreamer 1985; Dreamer and Pashley 1989; Lawless & Yeun, 1979; Yuen et al. 1984). These include fatty acids similar to the albumin of egg yolk.

In addition, Hoover and colleagues (Hoover, 1997, 2006; Hoover and Rozanov, 2003; Hoover et al. 1998, 2003, 2004) have examined a number of additional carbonaceous meteorites (i.e., Acfer, Alais, Dar al Gani Kainsaz, Karoonda, Mighei, Murray, Nogoya, Rainbow, Tagish Lake) and have detected microstructures similar to nanobacteria (50�400 nm) and spherical bodies (1 �m�20 �m) embedded in the meteorite matrix, resembling cocci, chroococoid and cyanobacteria.

Many of these meteors have been impacted by supernova (Birck 2004; Jadhav et al. 2006, 2007; Elgoresy and Ramdohr, 1980; Shukolyukov and Lugmaira 2006) and predate the origin of this solar system.

12. Discussion: Contamination & the Origin of Earthly Life

Critics commonly dismiss all evidence of microfossils in meteors by claiming contamination. Likewise, evidence for the presence of life during the Hadean eon have also been attacked as due to contamination.

However, claims of contamination are not proof of contamination. No one has ever conclusively demonstrated this overwhelming body of evidence, from numerous independent investigators, is in fact due to contamination.

If these findings of microfossils are due to "contamination" then we must ask: why does this "contamination" only occur in stony meteorites? As reported by Hoover (2006), ten non-carbonaceous meteorites were studied including iron meteorites. Not one was found to contain microfossils or evidence of life.

Innumerable Earthly microbes feast on metals. It is not likely that microbes from Earth would leave their fossilized signatures deep within stony meteors, but avoid those consisting of silicates, irons and other metals.

Iron meteorites are believed to have originated in the molten core of a much larger body, and thus would never have been expected to harbor life. By contrast, many chondrites, although linked to comets, likely originated as part of the deep surface layers of a planet or planetesimal (Ehrenfreund et al. 2001) and are similar to rocks found on the surface of the Earth. As such chondrites and not iron meteors would be expected to harbor life prior to crashing to Earth.

For example, mineralogical and petro-graphic evidence and the presence of carbonates and sulfates within these chondrites indicate considerable aqueous activity (Fredriksson and Kerridge, 1988; Bostrom and Fredriksson 1966; Kerridge, 1967) and possibly an original environment similar to permafrost (Dufresne and Anders 1962). When coupled with oxygen isotope data (Clayton and Mayeda 1984) it appears these chondrites were not formed in a nebular cloud. In fact, as based on an analysis of the amino acids of the Orgueil, Ivuna and Murchison meteorites it is possible that each originated on a different planet (Ehrenfreund et al. 2001).

Given these different histories, chondrites would be expected to have been infiltrated with microbes before they struck the Earth. The same would not be expected of iron meteors. If due to contamination, both types of meteors should contain microfossils and they do not.

The question of contamination is not an argument against extra-terrestrial life, but instead explains how life originated on this planet: via contamination.

No one has ever demonstrated that Earthly life can be produced from non-life, at least on Earth. The maxim: only life can produce life, has never been discredited. Therefore, based purely on the facts and scientific evidence, the only reasonable explanation is that the first living creatures to appear on this planet were produced by other living things which arrived on Earth safely encased in the debris which was bombarding this world during the Hadean eon.

The evidence detailed in this paper provides a scientific explanation for how life originated on Earth, and why there is evidence of biological activity in banded iron formations dated to 4.28 billion years ago (O'Neil et al. 2008), within metasediments in Western Australia formed 4.2 billion years ago (Nemchin et al. 2008), and thus why life appeared in the oldest rocks on Earth while the planet was still forming. Likewise, the presence of life within extra-terrestrial debris accounts for the biological activity within rock formation located in West Greenland, and the nearby Akilia island dated to almost 3.9 billion years in age (Manning et al. 2006; Mojzsis et al. 1996) and in 3.8 million year old quartz, recovered from Isua, S. W. Greenland, and which included microfossils resembling yeast cells and fungi (Pflug 1978). Independently obtained evidence of biological activity including photosynthesis was also discovered in this area dated from the same time period (Rosing 1999, Rosing and Frei 2004).

Furthermore, microbe infested meteors which bombarded the inner planets during the Hadean era can also account for the evidence of microbial life in a meteor from Mars (McKay et al 1996) which has been variably dated from 4.5 to 3.8 BY (Ash et al. 1996; Jagoutz, 1994; Nyquist et al., 1995; Wadhwa and Lugmair 1996).

13. The Earth is Not the Center of the Biological Universe

"Living things are specified with incredible delicacy and precision down to the level of individual molecules and atoms. It is simply impossible for a random mixture of relevant and irrelevant molecules and atoms to individually sort themselves out, expell those which are irrelevant, and then assemble those which remain thereby giving life to non-life." -Nobel Laureate, Francis Crick (1981).

The question of origins has been debated for thousands of years. According to the Greek philosopher, Anaximander (610 BC�c. 546 BC), life first emerged when watery soil was evaporated by the sun, and there followed a progression of life forms which became increasingly complex (Kahn 1994; Plutarch, Symposium 8). Over the ages many scientists have accepted this view as there is an intuitive appeal to the claim that life came from non-life. And yet there is no proof to substantiate this claim, and "intuition" like other beliefs without factual foundation, is not science.

Yet other factors contribute to the widespread faith in abiogenesis as an explanation for the origin of life on Earth, including religion and the magical thinking characteristic of early childhood, where inanimate objects such as toys, shadows, rocks, and so on, can be endowed with life. Piaget (1955, 1958) referred to this intuitive, egocentric stage of intellectual development as "Preoperational." Preoperational thinking dominates during the ages of 2-4, when children believe the world revolves around them, and where they assign living attributes and even personalities and purposeful behavior to inanimate objects. It is difficult to completely escape these influences, for the child is father to the man.

Therefore, whereas the child saw him/herself as the center of the universe and believed non-life could be endowed with life, many in the scientific community would have us believe the Earth is the center of the biological universe, where non-life gave rise to life; and revolving around us, the non-living cosmos.

In this article no attempt is made to explain the origins of life. However, given the incredible vastness and unknown age of the universe, and the little blue dot we call Earth, isn't it reasonable to assume life would have emerged somewhere in the cosmos long before it appeared on this insignificant spec of dust? Certainly, the world does not revolve around us, the Earth is not the center of the solar system, and our planet is not at the center of the biological universe.

The age of the universe is unknown, though speculation abounds. Those believing in a Big Bang universe have provided a wide range of birth dates over the last 80 years, ranging from 2 billion to over 20 billion years. However, there is also substantial evidence indicating the universe may be infinite (Joseph 2010), and in an infinite universe, life has had infinite opportunities to arise from infinite chance combinations of the necessary ingredients.

14. Conclusion

"If Life were to suddenly appear on a desert island we wouldn't claim it was randomly assembled in an organic soup or created by the hand of god; we'd conclude it washed to shore or fell from the sky. The Earth too, is an island, orbiting in a sea of space, and living creatures and their DNA have been washing to shore and falling from the sky since our planets creation" (Joseph, 2000).

Evidence for biological activity appears in the oldest rocks on Earth, during a period of heavy bombardment while this planet was forming. Biological activity in a meteor from Mars dates from the same period.

Microfossils have been detected in fifteen carbonaceous chondrites, almost all of which have been impacted by supernova, and several of which may have originated on planets that predated the origin of this solar system.

Our sun and solar system were created from the nebular debris spawned by a red giant which exploded in a supernova, nearly 5 billion years ago. The sun and our solar system may have been created within 100 million years of this explosion. Planets, such as Earth, may have originated in the star system which gave birth to our own, and then grew by accretion after becoming captured by the new proto-star which would become the sun.

Spores can survive from 250 to 600 million years; which is more than enough time to take up residence on planets made up of the debris which pounded new Earth. Bacteria are perfectly adapted for surviving the hazards of space, and could not have acquired these abilities if their ancestral experience had been confined to Earth.

Life on Earth appeared while this planet was still growing by accretion. There is no proof life can be created from non-life. Certainly it is possible life may have first been generated on an ancient world or in an environment with a chemistry completely unlike the Earth. Nebular clouds are excellent candidates (Joseph and Schild 2010a,b). If the analysis of increasing genetic complexity provided by Sharov (2006, 2009) is verified by others and our genetic ancestry does lead to a life form which first achieved life 10 billion years ago, then it also seems reasonable to assume that the nature of the Milky Way galaxy at that time provided the conditions necessary for the establishment of life; i.e. nebular clouds. If correct, then the sequence of stellar events described in this paper could also be applied to the descendants of that first life form, such that over the ensuing 10 billion years this galaxy was seeded with life which originated in a nebular cloud.

The theory proposed in this paper also lends direct support to the "life cloud" speculations of Sir Fred Hoyle (1957) and Chandra Wickramasinghe (Hoyle and Wickramasinghe 1978) and the impressive body of evidence Hoyle and Wickramasinghe (1993, 2000) have marshaled for comets as celestial mechanisms which seed planets with life.

However, the fact remains there is no evidence life on our planet began in an organic soup via abiogenesis. As only life can produce life, only panspermia is a viable scientific explanation as to the origin of Earthly life. The first life forms to appear on Earth were produced by other living creatures who were likely encased in debris from the shattered remnants of those planets that circled the parent star nearly 5 billion years ago.

Life on Earth, came from other planets.

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