

Did God Use 200-Bit Encryption While Forming the Building Blocks of Life?

Derek Marshall

B.A. Physics, 2006. Michigan State University

<http://www.CreationFunction.com>

East Lansing, MI

dmarshal@mtu.edu

Abstract

Proponents of evolution and abiogenesis continue to be inspired by the Miller-Urey type electric discharge experimental results as evidence that life may have spontaneously appeared on Earth 3.5 billion years ago. However, closer examination of 3 examples of these experiments reveals that their design mirrors the Creation pattern laid out in the first three days of the Genesis account. All of the examined works used elements solely from the first 3 periods of the periodic table of the elements. In addition, the use of only Hydrogen, Carbon, Nitrogen, Oxygen, and Sulfur in the experiment combinatorically creates the 10^{60} compound organic “chemical space” of molecules with 30 atoms or less and masses less than 500 Daltons. This chemical space model estimates that the more atoms, side chains and aromatic rings specified for a targeted compound, the less chance it will form randomly. The model also can estimate how much of less complex organic materials will form before a more complex biological molecule will form. Therefore, the larger, more complex biological molecules targeted in the Miller-Urey experiment should have lower yields than the smaller, simpler compounds. We found that the Chemical Space Model has an average correlation of 68% with the Miller-Urey experimental yield data, with the “Classic” and “Volcanic” yield data both correlating 72% to the model. The applicability of the chemical space model to real-world experimental results gives weight to the hypothesis that God used combinatorics to systematically hide a handful of biologically necessary organic molecules among approximately 2^{200} possible “organic” molecules. This is a literal form of “200-bit encryption”, and is evidence of design.

Introduction

The feasibility and application of the results of the Miller-Urey experiments to an abiogenic terrestrial beginning of life on Earth have been debated by researchers (Ferus, et al., 2017). However, this idea still captures the imagination of lay people and is a ready source of false inspiration that this is how life first began on the Earth (Bergman, 2000). Even now, articles meant for the consumption of the general public still tip their hat to this idea because of how easy it is to assimilate. These articles always tout Miller-Urey's formation of amino acids, and other similar experiments formation of nucleobases (Ferus, et.al, 2017). With these, it is easy to make the leap of thought that this is enough to seed the formation of life. However, what is usually glossed over or not mentioned at all is that it is not the nucleobases themselves that form the RNA or DNA polymer.

In the case of RNA, A nucleobase must first obtain a ribose sugar to allow it to be structurally a part of the spiral staircase structure of the genetic material. In the case of DNA, a deoxyribose sugar must be attached the nucleobase. Either way, with its sugar backbone, the nucleobase becomes a nucleoside. It is this very first step in becoming RNA or DNA that befuddles all observation made from laboratory experimentation. To date, no nucleosides or nucleotides have ever been isolated from biosynthesis experiments attempting to duplicate early conditions on Earth (Stout, 2019). In addition, no nucleosides or nucleotides have been obtained via biochemical analysis of Extra-Terrestrial materials found on Earth or in space. Whenever they are reported as having been isolated, it is always a designed laboratory experiment which starts with precursor materials, seeking a pathway from precursor material supposed present in early Earth chemistry. One reason we don't see these larger molecules formed is because as biosynthesis experiments proceed, formic

acid is produced as a by-product (DeMassa and Boudreaux, 2013). This acid would break down these larger nucleosides before they would have a chance to go to the next step. The formation of unintended substances during these types of experiments is a common theme, and this idea will be explored further in this paper.

Statistical and probabilistic barriers to form RNA and DNA molecules and proteins have also been put forth in the literature. Doug Sharp gives an excellent summary of the “left-handed amino acid dilemma,” summarizing James F. Coppedges’ probabilistic estimates of 2^{410} for the formation of an average protein molecule of 445 amino acids (Sharp, 1977). However, the idea that persists is “sometime in the billions of years, somewhere in the infinite universe, anything can and will happen, no matter how improbable.” The necessity for evolution to invoke “deep time” implies that they accept that the abiotic formation of the molecules necessary for life is highly unlikely. Here we will present more probabilistic complications associated with the “primordial soup” theory, and show that they are equally effective in preventing the random formation of biologically important molecules. A virtually incalculable quantity of molecules with 30 atoms or less and masses less than 500 Daltons can be produced from Hydrogen (H), Carbon (C), Nitrogen (N), Oxygen (O) and Sulfur (S), among only the first 18 elements of the Periodic Table of the Elements. One Dalton (Da) is a unit of molecular weight exactly 1/12 the mass of a Carbon-12 atom. This is an active topic of research in the pharmaceutical industry, and is referred to as the Chemical Space (Reymond, et al., 2010). The Chemical Space is estimated to contain 10^{60} or 2^{200} possible organic molecules with masses under 500 Daltons (Bohacek, et. al, 1996). Since C, N, O, H, and S were the only elements present in the Miller-Urey experiments, we can apply the Chemical Space Model to the Miller-Urey yield data. The model predicts

that the more atoms, side chains, and rings a specified molecule has, the more difficult it is to synthesize without forming undesirable byproducts. Therefore, in Miller-Urey we should see a predictable decreasing trend in yields as the larger, more complex molecules targeted are formed.

The discrete structure of the Periodic Table of the Elements would allow a designer to “mix and match” various elements to form compounds, a form of combinatorial construction. To use combinatorics in conjunction with the first 18 elements of the Periodic Table to conceal the handful of precious amino acids, nucleobases, nucleosides, nucleotides that together form proteins, RNA, and DNA in this chemical space is a form of encryption. This is similar to what computer scientists do to protect the private messages we send over the internet. And encryption is evidence of design. We will show encryption is a Biblical principle echoed in the Word as well as a mathematical principle correlating to actual experimental data.

Encryption is a Biblical Principle Designed by God

The thesis of this paper is rather intuitive: The larger the molecule, the more difficult it is to produce. This idea is not new, it was expressed by Dr. Emmett Williams: “It should be obvious that if it is difficult to form simpler compounds, it would be almost impossible to form more complex compounds” (Williams, 1967). His was from a thermodynamic and kinetics standpoint, which are quantitative measures of how a chemical process will proceed. As stated earlier, we are going to focus on the probabilistic aspect of this substantial barrier to forming biological molecules from the standpoint of encryption. What is encryption?

Encryption, as it is used in computer science is a very complex subject, well beyond the scope of this paper. However, the basics of encryption are very instructive and enough to make the case for how God employs it to control and protect the formation of living things. Paraphrasing many results of a simple web search of the term, encryption has 4 main elements: The original message, the algorithm, the encrypted message, and the key to recoup the original message. In our case, the message will be that special sequence of elements from the first three periods of the Periodic Table, required to form a living thing. The encryption algorithm is the manner and sequence in which God manufactured all of the constituents that make up the crust of the Earth, and the frequency and concentrations in which the biological compounds were embedded in this medium. And, also this algorithm would include all of the possible combinations of these 5 elements that can be made via incidental chemical interactions that could occur as time passes. As we stated earlier, this would be the chemical space. The resulting encrypted message would be the very soil and waters of the Earth itself created and finished on the third day, ready to bring forth life. Also created and finished on the third day were the first life forms: plants, trees, grasses and herbs along with the seeds which are required to bring forth this life. So important are these seeds that the word “seed” is repeated 4 times in Gen. 1:11-12. And it is these seeds which are the encryption “keys” required to extract the message “LIFE” from the dust of the Earth. But why did God have to encrypt life? Is there a Biblical reason or pattern?

We know from the Word of God that there was an enemy lurking in the Garden of Eden, namely the Serpent aka Satan and the Devil. We also know from the story of Moses and Pharaoh that Satan and his forces possess the ability to appear to manipulate matter. In

Exodus 7:10, when Moses demonstrated God's power by casting his rod to the ground and having it come to life as a serpent, we see that Pharaoh's magicians were able to do an appearance of the same, only until Moses' serpent swallows the false serpent of Pharaoh's magicians. Also, taking the same idea to the extreme, Jesus Christ is LIFE itself. He was literally "encrypted" into the Earth only to be raised again to life after 3 days according to the Word of God. Recall from Jesus explanation of his parables that "the seed is the Word of God." Another example of this principle is Christ's parable of the sower (Mt 13:3-9). It matters where the seed is planted. Abundant life is only the result of the seed being planted in the good ground that contains "deepness of Earth", not the ground that contains thorns which "choke" the production of fruit and life. Thorns could represent non-life-giving organics which are produced more easily. So, with these examples we also have the complete encryption pattern. Encryption is also necessary is also because we read in the Revelation that there shall also be an imposter raised from the Earth which is the antichrist. One more example of this pattern is that when Christ was resurrected and appeared to His disciples, He stated that He alone held "the keys to death and hell", characterized in the Bible as places of bondage.

The First Three Periods of the Periodic Table of the Elements May Correspond to the First Three Days of Creation

The Periodic Table of the Elements present an orderly assembly of individual parts from which God literally constructed His Creation. Examining the first three periods of this table, one finds a qualitative correlation with the first three days of Creation. For example, Day 1 was the creation of light and Period 1 of the table contains hydrogen (H) and helium (He) which we know powers the Sun. Day 2 was the creation of the firmament and we see

in Period 2 the elements carbon (C), nitrogen (N), and oxygen (O), which make up our atmosphere. The Genesis Creation presents that life began during Day 3. On that day, we see the creation of trees, herbs, and grasses when the waters were “gathered together in one place”, letting “the dry land appear.” We also see in Period 3 of the Periodic Table the abundant metals of Earth, which make up its crust and also include sulfur (S) and phosphorus (P) which form the molecules necessary for life. This qualitative correspondence is very interesting, but is not enough evidence by itself to make the correlation.

One must assume that God created the Periodic Table of the Elements, but how can we know? Are there any fundamentals of design in the Periodic Table that we can attribute to God? We can begin with the Creation pattern itself: The first chapters of Genesis describe a creative pattern consisting of 6 days and 6 nights. We accept that these are literal days and nights: Therefore, these are 6 full rotations of the Creation; 12 half rotations if you take into consideration individual days and nights. Genesis is not the only place in the Bible that describes how the Creation was formed. How did God do it? Did he use any tools? Was there a process involved which we could emulate in a mathematical model? We have found 4 passages that describe in more detail how God formed His Creation.

“When he prepared the heavens, I was there: when he set a *compass* on the face of the depth.” (Prov. 8:27).

“Lift up your eyes on high, and behold who hath created these things, that bringeth their host out *by number...*” (Is. 40:26).

“Thine eyes did see my substance, yet being unperfect: and in thy book my members were written, which *in continuance* were fashioned...” (Ps. 139:16).

“How precious are thy thoughts unto me, O God! How great is the *sum* of them!” (Ps. 139:17).

These four passages answer many of the questions posed. First, God did use at least one tool while creating: A compass. And we see terms in the other three passages that would be interesting to a mathematician: “brought out by number”, “in continuance”, and “sum”. In school, we are taught how convert a story problem into a mathematical expression. And the terms we just examined do define a well-known relationship in calculus called the Harmonic Series. If we combine the summation of the Harmonic Series with a 360° “compass”, and restrict it to the first 18 iterations, corresponding to the first n = 18 elements of the Periodic Table, and restrict the output to 360° or less, we obtain (1):

$$(1) f(18) = \text{mod } 360^\circ \left\{ \sum_{n=1}^{n=18} \frac{360^\circ}{n} \right\} = \text{mod } 360^\circ \left\{ \frac{360^\circ}{1} + \frac{360^\circ}{2} + \dots + \frac{360^\circ}{17} + \frac{360^\circ}{18} \right\}$$

This formula fulfills the four scriptures: It uses a 360° compass. It brings forth its result number by number, from 1 to 18 in this case. It is a summation, and by definition it works continuously from n = 1 to n = 18, resulting in a final sum.

When we run (1) stepwise, we see the result in Table 2. We are looking for the “n” Step numbers that correspond to the 180° and 360° points; also refer to Figure 1: These represent the Day and Night crossings as God’s compass is rotating during His Creative movement. With Step 1 as the “Beginning”, we see that these crossings occur at Steps 2, 3, 6, 10, and 18. Comparing these to the numbers “brought out” by the Periodic Table of the Elements, we find that 5 of the 6 numbers fall at the beginning or the end of the first three periods of the Periodic Table. And if you count the number of 180° crossings, you will see that the process ends in the third revolution: corresponding to the third Day of Creation, and the third period of the Periodic Table of the Elements.

It is interesting to note that the structure of organic chemistry itself is evidence of “design and construction” (Brauer, 1971). And adding the 3rd period of the table gives an additional

8 elements for a total of 18. Among these 18 elements, God chose to use mainly 6 elements H, C, N, O, S, P to create the vast majority of life-giving molecules. Interestingly enough, the Miller-Urey experiment also was designed to use 5 of the 6 elements mentioned from the first 3 periods of the Periodic Table of the Elements to form the building blocks of life. And, by design, it is these five individual elements that create the innumerable possibilities of molecular organic structures that can be formed.

By Design, God May Have Used Combinatorics to Create the Chemical Space

The “Chemical Space” is an active topic of research in the pharmaceutical industry (Reymond, 2012). Its existence implies that one should be able to use special algorithms to canvass all of the possible combinations of atoms that could form therapeutic medicines and drugs. The best candidates for drugs tend to be comprised of C, H, N, O, S; and have 30 or less atoms, with a total molecular weight to under 500 Daltons (Reymond, 2012). It is estimated that the chemical space contains over 10^{60} compounds (Bohacek, 1996). We are using this concept in this paper, because the definition of this chemical space is immediately applicable to the Miller-Urey experimental results in two ways:

The precursor compounds used in the Miller-Urey experiment were also limited to those comprised of C, H, N, O, and S. Also, the nature of the experiment was to turn on a spark generator and see what organic compounds would randomly form over the course of a week. Any of the different combinations of these 5 elements were theoretically possible within the constraint of time, kinetics, and chemistry. With 10^{60} compounds possible, it would take the evolutionist’s age of the Earth, 4.6 Billion years to get to all of them, even if they were formed at a Planck Time rate, one every $5.4 * 10^{-44}$ second (Thornton, 2002).

All of these possibilities arise from God's decision to use 5 or 6 different elements in various combinations to form the biological molecules of life. This is likened to a digital combination lock. Most literally, this is an application of combinatorics, an active field of study in mathematics. The chemical space is a combinatorial model designed by God. We have employed this model for comparison to the Miller-Urey experimental results. The model as stated in the literature, takes the following mathematical form (Bohacek, 1996, pp. 41):

$$(2) \text{ Number of Possible Compounds} = m^n * ((n * (n - s - 1)/2)^r) * (n^2)^b$$

Where,

- n = Number of atoms (not counting hydrogens)
- m = multiplicity (number of element and bond combinations of C, N, O, S)
- r = Number of rings
- b = Number of branches
- s = Size of ring(s), must subtract one from ring size, hence "s-1" term

Example: 30 Atoms, 10 Rings of 3 atoms, 4 Branches, Avg. multiplicity of 6

$$6^{30} * ((30 * (30 - 3 - 1)/2)^{10}) * (30^2)^4 = \underline{\underline{2.5 * 10^{61} \text{ Possible compounds}}}$$

This model increases at an exponential rate as the number of atoms, rings, branches and multiplicity increases. Interestingly enough, this model also equates to approximately 2^{200} different molecular combinations, in a binary sense. Using the Chemical Space Model, if one were to accidentally make one 500 Dalton biological molecule on the scale of ATP, one would also have to sort through more than 10^{25} metric tons of "other" molecules, equivalent to the mass of 2250 Earths. In other words, to make one single nucleotide-scale biological molecule, you would have to form 2250 planets like ours. As stated earlier, to hide less than a "byte" ($<2^8$) of biologically necessary molecules among approximately 2^{200} others

is a form of encryption, and therefore, evidence of design. Does this Chemical Space model correspond to examples of real-world random formation of biological molecules?

The Miller-Urey Experimental Setup: Three Experiments

We examined 3 Miller-Urey results here for this paper. Three of the actual experiments were done in 1950's, and after Miller's death in 2007, the materials from these experiments were re-examined using state-of-the-art chemical analyses (Johnson et al, 2008). The first Miller-Urey result was from the "classic" experiment. This was analyzed alongside another trial referred to as the "volcanic" experiment which attempted to simulate the conditions found near the volcanos suspected to be prevalent on the surface of a young Earth. The third experiment added hydrogen sulfide to the Miller-Urey precursor materials, again trying to simulate which compounds may have been available for an abiotic chemical reaction in the early stages of Earth development 3.5 Billion years ago (Parker et al, 2011). All three Miller-Urey experiments produced amino acids which are necessary for life. When the "classic" experimental results were published in 1953, it was big news. We are still living under the shadow of that discovery, even though most researchers do not believe that the experimental design was applicable to early Earth. We will examine the results of each and show that these results wield a two-edged sword when it comes to showing what is possible abiotically under random circumstances and what is not. We believe that it is important to note that Dr Stanley Miller said of his famous experiment

"In this apparatus an attempt was made to duplicate a primitive atmosphere of the earth, and not to obtain the optimum conditions for the formation of amino acids" (Miller,1953).

It was believed at the time that an early Earth atmosphere could have been anaerobic, i.e. without oxygen gas, and therefore, reducing (Oparin, 1953). Simplicity seemed to be key with the apparatus in Figure 2 being comprised of a 5-liter reaction flask, fitted with electrodes for an electric spark from a Tesla coil, a boiling flask to hold and boil liquid water, and a condenser (Miller, 1955). The “primitive Earth atmosphere” included hydrogen gas, gaseous ammonia and methane. The main ingredient of the experiment was 200 mL of water in the boiling flask which was to be brought to boiling to produce enough steam to mix with the other gases in the presence of the spark. The water vapor would proceed in a clockwise direction into the condenser and rejoin the liquid water at the bottom of the smaller water flask. Any products formed by the spark reaction would deposit on the surface of the reaction flask, condense and flow back down into the boiling flask via the “U-tube”. After one day of operation, the water in the boiling flask turned noticeably pink, and the end of a week the mixture was “deep red and turbid” (Miller, 1953). The reaction was then stopped, and product streams were carefully isolated by various chemical means (Miller, 1955). Originally, the quantitative analysis of the effluent was done using paper chromatography, method of choice in the 1950’s. Several prebiotic amino acids were isolated and the results were promptly reported (Miller, 1953). The second Miller-Urey reactor shown in Figure 3 added an aspirator above the boiling flask in order to concentrate a blast of steam towards the electrodes in the adjacent reaction vessel. An application of this was to simulate how nearby volcano would affect the reactions (Johnson, et al, 2008). The results of volcanic “Run 2” with the aspirator were reported alongside the detailed report of the classic “Run 1” without the aspirator in Miller’s 1955 paper. Being limited to the analysis techniques of 1955, not much separation was achieved

between the results of Run 1 and 2. Run 3 of the 1955 paper was the “silent” method of introducing an electrical discharge to the gaseous mixture and is not of interest to this paper. However, a substitute Run 3 is offered by this paper: It is the H₂S-rich experiment later performed by Miller in 1958 which went unreported until 2011 (Parker, et al, 2011). This trial also used the “volcanic” apparatus described above and shown in Figure 2. It introduced an additional H₂S gas component often found in volcanic plumes (Parker, et al, 2011).

The Analysis of Three Miller-Urey Experimental Results Shows a Molecular Weight Cutoff

The Miller-Urey combined results show that the experiment yielded 15% amino acids of all varieties, proteogenic or not, and 85% of everything else. There was 4200g of Carbon added to the reactor and only 603g of the targeted amino compounds measured (Miller, 1955). This leaves at least 3600 g of random, unrefined carbon compounds: “tar”.

Refer to Figures 2 and 3. Where the analytical methods of 1955 did not offer much difference between Runs 1 and 2, the HPLC, UV Florescence and TOF-LCMS technology employed in 2008 on these reconstituted samples showed that the volcanic apparatus produced more varieties of amino acids than the classic apparatus (Johnson, et al, 2008, Supplemental Material). It is believed that the steam directed into the electrical discharge generated hydroxide ions which could have additionally reacted with amino compounds formed (Johnson, et al., 2008). Of interest is that the abundances of the amino products reported decrease exponentially with increase of molecular weight. Refer to Figure 4. The highest amino compound formed in the classic experiment was Glutamic acid with a molecular weight of 147 Da. The experimental data had an R-squared value of 0.46 which

We believe is appropriate for the following reasons: We used a very low molar ratio value, 10^{-9} to represent compounds “not found” in comparison to the volcanic apparatus results, since there is no “zero” in a logarithmic plot. And We include “not found” data to enhance the trend’s response to the difficulty in forming these “targeted” amino acids. The “not found” data points will upset the R-squared value, as will the fact that these unique products of reactions are subject to their individual chemistry and will not necessarily follow a mathematical curve based upon yield. Another reason we are comfortable with the R-squared values in all these experiments shown is that one can see the trend in each case. We want to emphasize again that we are not trying to predict yields, we are merely showing that there is a cutoff molecular weight that is well below the 500 Da molecular weight needed to even begin a conversation about abiotic formation of the nucleotides necessary to produce DNA. The Classic model trendline predicts a cutoff molecular weight of 164 Da, with a molecular weight increase of 146 Da above the largest precursor reagent, water. This cutoff is based upon a molar fraction 10^{-9} well below the detectable threshold implied by the results reported, and well below any useful amount of substance. The classical setup produced 6 of the 20 biological amino acids along with 8 other amino compounds. Using the volcanic apparatus, the largest proteogenic compound formed was phenylalanine with a molecular weight of 165 Da, with a molecular weight increase over yield of 147 Da above the molecular weight of water, 18 Da. Figure 5 shows the Volcanic trendline predicting a 180 Da cutoff. The volcanic setup produced 7 of the 20 biological amino acids along with 15 other amino acids. Figure 6 displays the H_2S experimental result, using the same type of reactor as the volcanic run, produced 10 of the 20 biological amino acids along with 14 other amino acids. The largest amino substance reported for the H_2S was Homocysteic

acid with a molecular weight of 183 Da. This trendline for the H₂S has a lower R-squared value of 0.31, much for the same reason stated earlier. This data has more “not found” substances to keep the list of species targeted the same across the 3 experiments. Refer to Figure 7 to see a 3-D “stick and ball” model of some of the targeted amino acids to see the complexity increase required to get to the larger “not found” species. The H₂S experiment included sulfide gas whereas the other two experiments did not. Therefore, we did not list sulfuric compounds as “not found” in the two runs which did not have sulfur. The addition of H₂S as a precursor reagent was significant in the final product molecular weight. But taking H₂S with molecular weight of 34 Da into account as the largest precursor, and a trendline predicting a cutoff of 180 Da. In this case the actual largest molecular weight molecule produced was 183 Da, a molecular weight increase of 149 above H₂S, very similar to the 147 Da increase over the heaviest molecule found in the volcanic reactor. The similarity and repeatability of this reactor to produce such a similar increase in complexity of molecules, even though the experiments were done years apart and with a different set of reagents, is noteworthy.

Very Recent “One Pot” Experiments to Produce Nucleosides Show Need of Design to Create Larger Biological Molecules

In the spirit of Miller-Urey, researchers are still looking for a “one-pot” solution to get small molecules to organize into large, complex macro-molecules, especially those directly responsible for the construction of DNA and RNA. This paper has chosen to focus on the synthesis of nucleosides from the small precursor materials of Miller-Urey, even though any one-pot solution must also include all 20 amino acids. In October 2019, just last month from the time of this writing, a Science article was published claiming a “unified

prebiotically plausible synthesis of pyrimidine and purine RNA nucleotides” in a “one pot” manner (Becker, et al, 2019). The difficulties they are trying to overcome is the prebiotic, “one-pot” and, “simultaneous” generation of pyrimidines and purines into nucleosides and further nucleotides. They submit several pathways to accomplish such and submit impressive lab results having successfully abiotically produced nucleosides cytidine and uridine. In one scenario, their starting materials in the pot are cyanoacetylene and hydroxylamine. These are given as “acceptable prebiotic” materials because cyanoacetylene forms from electric discharge under CH₄-N₂ (Muchowska, et al., 2019) and hydroxylamine, while they freely admit it is unclear where it comes from, can arise prebiotically also from lightning with N₂ and CO₂ after several steps including the formation of anions nitrate and nitrite, the addition of sulfuric acid, and a subsequent hydrolysis to purify the targeted amine. This reasoning is troublesome. So far, we need one pot to create cyanoacetylene, and 3 pots to get hydroxylamine. Then, we need a pot to put the two together to form 3-aminoisoxazole, molecular weight of 84 Da. Then Urea, molecular weight 60 Da, is added to form a large N-isoxazole-urea complex. Another pot is brought in for a reaction with added boric acid, molecular weight 62 Da and added ribose, molecular weight 150 Da to produce a large ribosylated product of molecular weight 293. This intermediate product needs another pot to react with borates to isolate the furanosides. Then “the final step” is “reductive opening of the isoxazole N-O bond, followed by tautomerization, intramolecular cyclization, and water elimination in a cascade-like fashion. We found that this reaction occurred rapidly with Fe²⁺ in the presence of thiols” (Becker, et al, 2019). With this final step being 5 steps, we have a total of at least 12 pots. Also, we see a maximum molecular weight increase cutoff of 143 Da during their recursive

experiments, going from the large N-isoxazole-urea complex to the large ribosylated product. Their explanation of how this is a “one pot” reaction is that during early Earth, there were wet and dry cycles, cyclic water currents and weather, with cyclic heat and cold with natural changes of pH and natural serial addition of “prebiotic” chemicals e.g. Urea and many others to form this nucleoside abiotically. Everyone knows that complex chemicals can be synthesized, but to assert how this is “plausible” with no guidance or observer on the ground is not science. Cyclic dry and wet, high temperature, low temperature, high pressure, low pressure, high and low voltage cycles are all forms of information. If this is what the “Earth” was doing when these compounds were formed, then one must accept that there was a source of this information given and stored in the Earth, somehow extracted out of the chaos of early Big-Bang space. Invoking an Earth imbued with information, or an “Informed Earth”, is not a random process, and not a true abiogenic or abiotic process. This logic likens to Earth to a large catalytic machine, an oversized biotic enzyme, that is taking small separate molecules and forming pure organic macromolecules and sequestering them to later continue form large continuous polymeric proteins while at the same time, selecting only the left-handed ones to catalyze the formation of RNA and DNA. The problem we have with stopping this rampant, non-scientific form of inquiry is that the Earth is full of information at all levels of complexity and scale. Atoms are full of information of how they combine with relative sizes so neatly arranged that we can tabulate them, a.k.a. The Periodic Table of the Elements. Molecules themselves contain, and once formed, retain information such as phase, temperature, pressure and relative mass. The point is that we bring all this information into our

experiments as simple and pure as they may seem. Therefore, we say that an experiment is random, when it really isn't.

Comparing the Volcanic, H₂S Rich Miller-Urey Experimental Results and “One Pot” to the Chemical Space Model

A computer-simulation of Miller-Urey modelled some reactions as favorable to occur within 1 pico-second (Saita and Saija,2014). Of note one example is aspartic acid, being 133 Da. This is one of the amino acids readily identified by Miller in 1953 by paper chromatography. The smaller compounds not only form in greater abundance, but also form more rapidly. It was reported that some of the amino acids produced by this type of experiment form immediately upon turning the reactor on. In a 1996 interview, Stanley Miller stated:

"Just turning on the spark in a basic pre-biotic experiment will yield 11 out of 20 amino acids" (Access Interview, 2008).

It is interesting to note here that rapid formation of molecules is more fitting for a young-earth scenario in which materials were formed on the order of seconds, minutes and hours of a day. Multi-step, recursive reactions must also follow the Chemical Space Model but to their detriment in that each trial now being on the order of seconds having to select against the 10^{60} possible C, N, O, S, organic compounds in the chemical space below 500 Da (Reymond, et al., 2010). There are 1.5×10^{17} seconds in 4.6 billion years, not enough time to create all the possible organics to arrive at any one targeted. A major result of the Miller-Urey experiment, the 85% tar yield, is compelling evidence of the Chemical Space Model. This Chemical Space equation (2) has a leading term “multiplicity” which renders the

exponential character of the model. Tar is generally defined as “a dark brown or black viscous liquid of hydrocarbons and free carbon, obtained from a wide variety of organic materials through destructive distillation” (Wikipedia, 2019). Hydrocarbons have low multiplicities of 1-3 compared to those of biomolecules with multiplicities of greater than 4. This implies that much higher yields of tar will always be present in a Miller-Urey type experiment in which an ultra-high-temperature source of excitation energy (spark, laser) is allowed to indiscriminately synthesize compounds.

Refer to Figure 4. The Chemical Space model correlates 72% with the “Classic” Miller-Urey experimental yield data. The correlation is calculated by taking the base-10 logarithm of both the Miller-Urey yield data and the Chemical Space Model prediction data and using the CORREL function in Excel. When the Chemical Space Model prediction falls below the arbitrary “not found” 10^{-9} molar ratio value, I decrease the “not found” entry to match the predicted value, since it also implies “not found”. The Chemical Space Model does not predict yields particularly well, but does show that there is a correlating trend predicting a clear cutoff with increasing molecular weight. The largest amino acid found was Glutamic acid with a molecular weight of 147 Da. The data shows an exponential trendline which extrapolates a 1nmol cutoff of 164 Da. The red trendline is the Chemical Space Model, which gives a 1 nmol “zero” crossing of 170 Da. These cutoff values being up to 23 Da larger than the “Classic” actual may be due to the apparatus itself, as we will see in the “volcanic” experiment.

Refer to Figure 5. The Chemical Space model also correlates 72% with the “Volcanic” Miller-Urey experimental yield data. The Chemical Space Model’s “Volcanic” trendline is the same as the “Classic” trendline, because the species examined are the same, rendering

the same model. These data show that there is a clear cutoff with increasing molecular weight. The largest amino acid found was phenylalanine with a molecular weight of 165 Da. The data shows an exponential trendline which extrapolates a 1nmol cutoff of 180 Da. The red trendline is the Chemical Space Model, which gives a 1 nmol “zero” crossing of 170 Da. These cutoff values being closer actual may be due to the “Volcanic” apparatus itself, characterized as a “slightly more efficient” reactor with the steam circulation emulating a volcanic environment (Miller, 1955).

Refer to Figure 6. The Chemical Space model correlates 61% with the “H₂S” Miller-Urey experimental yield data. The Chemical Space Model’s “H₂S” trendline is not the same as the “Classic” or “Volcanic” trendline, because the species examined are not the same, and with the added Sulfur component, the chemistry will be different. This experiment with the added H₂S had higher yields and more amino acids found than the previous two. However, the “H₂S” data also shows that there is a clear cutoff with increasing molecular weight. The largest amino acid found was homocysteic acid with a molecular weight of 183 Da. The data shows an exponential trendline which extrapolates a 1nmol cutoff of 188 Da. The red trendline is the Chemical Space Model, which gives a 1 nmol “zero” crossing of 177 Da. These cutoff values are also close to the actual since this experiment also uses the efficient “Volcanic” apparatus.

Extra-Terrestrial Results: Many Large Compounds Formed, but Those Macromolecules Needed for Life Conspicuously Absent.

With our Chemical Space Model being strengthened by what we observe in our laboratory experiments in regards to what can be produced in a short amount of time, we need to see if the model holds up in actual “Extra-Terrestrial experiments” outside of human control

that have persisted over the maximum amounts of time in question, i.e. billions of years. Extraterrestrial objects, such as meteorites and comets are such objects with the “carbonaceous” variety being among the most interesting. These space rocks are found on the surface of the Earth, either long after they have landed, or more desirably after eyewitness accounts of an object landing and immediately being taken and analyzed with a known proper chain of custody to insure purity. A specific famous example of a carbonaceous meteorite is that of the one found in Murchison, New Zealand. Much research and analysis has been done on the Murchison Meteorite in order to ascertain if it contains organic substances. If proteogenic species can be isolated from Murchison Meteorite, this could support the idea that the Earth was seeded from an Extra-Terrestrial source. However, this just puts the problem on another planet.

But to some, this is a plausible scenario because it is so far removed from us and anything is possible “out there”. Looking at Figures 9 and 10, we find on the Murchison Meteorite, LON 94102, QUE 99177 and EET 92042 carbonaceous chondritic meteorites, that they contain much the same amino acid compounds found in the H₂S Miller-Urey experiments (Johnson, et al, 2008, supplemental material). From Table 3 we see again even another study, that shows some interesting similarities exist between Miller-Urey yields and Murchison Meteorite amino acid compounds found (Wolman, et al. 1972). But in the same study, two particularly large amino acid derivatives were created in the Miller-Urey and the same two found in Murchison Meteorite. Now even though these two organic acids of molecular weight 269 and 281 Da were seen in the gas chromatography, they were not identified, other than knowing that they are derivatives of Valine, molecular weight 117 Da and Pimelic acid of molecular weight 129 Da respectively (Wolman, et al. 1972). It

is interesting to note that even on the Murchison Meteorite, a molecular weight increase of 152 Da is similar to the molecular weight increases seen in Miller-Urey and in Chemical Space model. To see that happened such an ancient object is remarkable. In another investigation of the Murchison Meteorite, they found “insoluble organic material” (IOM), large samples of random organics that are very hard to isolate and purify, many of which are larger than my 200 Da cutoff of the model (Schmitt-Kopplin, et al., 2010). This would be concerning at first glance because one could say that a 227 Da molecular weight nucleoside could then be formed given enough time. Again, this is major evidence for the efficacy of the Chemical Space Model. The IOM is comprised of the same low “multiplicity” compounds as “tar” seen in the Miller-Urey experiment (Schmitt-Kopplin, et al., 2010). So, even over deep time these simple, but higher molecular weight IOM yields far outweigh the more complex amino acids found in the Extra-terrestrial sources. But none of the precious nucleoside and nucleotides have ever been isolated from Murchison Meteorite or any other Extra-Terrestrial object, even with so many large organics being found. Therefore, these nucleobases found in these Extra-Terrestrial objects are “chemical dead-ends”, and this can be for many chemical reasons (Sarfarti, 2008). We believe another strong reason is that, as discussed earlier, with the chemical space of 10^{60} possible organics with molecular weight less than 500 Da, that 4.6 billion years is not enough time to randomly create one of a small handful of nucleosides we need for life.

Summary

The Periodic Table of the Elements present an orderly assembly of individual parts from which God literally constructed His Creation. Examining the first three periods of this table, one finds a qualitative correlation with the first three days of Creation. We developed a mathematical equation from scripture than produces a logarithmic spiral pattern that directly correlates to the first three periods of the Periodic Table of the Elements. Since this correlation exists, we can infer that this is evidence of design. Furthermore, the use of individual elements as a toolbox for Creation implies that there are virtually infinite combinations of these parts that could arise as organic compounds.

The Chemical Space is estimated to contain 10^{60} or 2^{200} possible organic molecules of 30 atoms or less and with masses under 500 Daltons. The Chemical Space Model equation is taken directly from the literature and applied to the Miller-Urey yield results. Having a handful of biologically important molecule “hidden” among the 2^{200} possible organic molecules of the Chemical Space is very similar to simple encryption techniques employed in “cyber-space”.

We analyzed 3 different versions of the Miller-Urey electric spark discharge experiment and identified a cutoff molecular weight for the targeted proteogenic products of these experiments of 170 – 177 Da. We found the Chemical Space Model had an average correlation of 68% with the Miller-Urey experimental yield data, with the “Classic”, and “Volcanic” yield data both correlating 72% to Miller-Urey.

We also discussed the large IOM samples found in the Murchison Meteorite and how, even though the opportunity existed for large molecules to “grow” on the Murchison Meteorite, no nucleoside or nucleotides have been found on an Extra-Terrestrial object to date, because this small handful of “targeted” proteogenic species to be produced is vanishingly infinitesimal in the face of the virtually infinite “chemical space” that exists for organic C, N,O,H,S molecules under 500 Da., especially when the less complex organics found in the IOM and “tars” will be produced at much higher concentrations as seen in the literature. Given the qualitative and quantitative correlation between the Periodic Table of the Elements and the Creation story, we conclude that the Periodic table of the Elements is evidence of design, and is a vibrant contributor to the Creation Model. In addition, the Periodic Table is the direct source of the combinatorial complexity that is the Chemical Space. With the correlation of the Chemical Space model to the actual Miller-Urey yield, we conclude that the Miller-Urey experiment is direct and compelling evidence of design, showing that as molecular weight increases for targeted biological molecules, the yield decreases at the same rate as the Chemical Space Model predicts.

The applicability of the Chemical Space model to real-world experimental results gives weight to the hypothesis that God used combinatorics to systematically hide a handful of biologically necessary organic molecules among approximately 2^{200} possible “organic” molecules. This is a literal form of “200-bit encryption”, and is evidence of design.

References

Bergman, Jerry. 2000. Why Abiogenesis is Impossible. *CRSQ* 36:195–207.

Bohacek, Regine S., McMartin, Colin, and Guida, Wayne C. 1996. The Art and Practice of Structure-Based Drug Design: A Molecular Modeling Perspective. *Medicinal Research Reviews*, Vol. 16, No. 1, 3-50

Brauer, Oscar L. 1971. Organic Chemistry Reflects God's Infinite Knowledge. *CRSQ* 8:9–12.

DeMassa, John M, Boudreaux, Edward A. 2013. Formic Acid: A Significance but Ignored Product in the Miller-Urey Experiment. *CRSQ* 49:211-217.

Ferus, M., Pietrucci, F., Saitta, A., Knížek, A. Kubelík, P., Ivanek, O., Shestivska, V., and Civiš, S. 2017. Formation of nucleobases in a Miller–Urey reducing atmosphere. *Proc Natl Acad Sci.* 114(17): 4306–4311.

Henahan, Sean. 2008. "Exobiology: An Interview with Stanley L. Miller". Accessexcellence.org.

Hull, D.E. 1960. Thermodynamic and Kinetics of Spontaneous Generation. *Nature* 186:693.

Johnson, Adam P., Cleaves, H. James, Dworkin, Jason P., Glavin, Daniel P., Lazcano, Antonio and Bada, Jeffrey L. 2008. The Miller Volcanic Spark Discharge Experiment. *Science* 322 (5900), 404.

Muchowska, K.B., Varma, S.J. & Moran, J. 2019. Synthesis and breakdown of universal metabolic precursors promoted by iron. *Nature* 569, 104–107

Parker, Eric T., Cleaves, Henderson J., Dworkin, Jason P., Glavin, Daniel P., Michael Callahan, Andrew Aubrey, Antonio Lazcano, and Bada, Jeffrey L. 2011. Primordial synthesis of amines and amino acids in a 1958 Miller H₂S rich spark discharge experiment. *Proc Natl Acad Sci.* 108(14): 5526–5531.

Philippe Schmitt-Kopplin, Zelimir Gabelica, Régis D. Gougeon, Agnes Fekete, Basem Kanawati, Mourad Harir, Istvan Gebefuegi, Gerhard Eckel, Norbert Hertkorn, 2010. High molecular diversity of extraterrestrial organic matter in Murchison meteorite revealed 40 years after its fall. *Proceedings of the National Academy of Sciences* Feb 2010, 107 (7) 2763-2768

Reymond J.L., Van Deursen R., Blum I.C., Ruddigkeit, L. 2010. Chemical Space as a Source for New Drugs. *ChemComm* 1: 30–38.

Saitta A.M., Saija F. 2014. Miller experiments in atomistic computer simulations. *Proc Natl Acad Sci.* 111:13768–13773

Sarfarti, Johnathan. 2008. *Nucleic Acid Bases in Murchison Meteorite?*
<http://www.creation.com>.

Sharp, Doug B., 1977. Interdependence in Macromolecule Synthesis: Evidence for Design. *CRSQ* 14:54–61.

Stout, Timothy and Matzko, George. 2019. *Creation Matters, A Natural Origin-of-Life: Every Hypothetical Step Appears Thwarted by Randomization.*

Thornton, Steven T. and Rex, Andrew. 2002. Modern Physics for Scientists and Engineers, 2nd Ed., p. 535

Wikipedia. 2019. <https://en.wikipedia.org/wiki/Tar>

Williams, Emmett L. 1967. The evolution of complex organic compounds from simpler chemical compounds: Is it thermodynamically and kinetically possible? *CRSQ* 4:30–35.

Wolman, Yechezkel., Havenland, William J., and Miller, Stanley L. 1972., Nonprotein Amino Acids from Spark Discharges and Their Comparison with the Murchison Meteorite Amino Acids. *Proc. Nat. Acad. Sci. USA*, Vol. 69, No. 4, pp. 809-811

Tables

Table 1: Amino Acids Targeted in Three Miller-Urey Type Experiments: H₂S, Classic, Volcanic. “Pro” if the compound is **Proteogenic**. N+R+BR is Number of C, N, O, S Atoms, **Multiplicity**, **Rings**, **Branches**, for Organic Chemical Space Model Calculation

mole (Da)	Name	Formula	H ₂ S	Cls	Vlc	Pro	A,M,R,B
75	Glycine	C ₂ H ₅ NO ₂	Y	Y	Y	Y	5,4,0,2
89	β-Alanine	C ₃ H ₇ NO ₂	Y	Y	Y	N	6,4,0,0
89	α-Alanine	C ₃ H ₇ NO ₂	Y	Y	Y	Y	6,4,0,0
103	β-Aminobutyric acid	C ₄ H ₉ NO ₂	Y	Y	Y	N	7,4,0,2
103	α-Aminobutyric acid	C ₄ H ₉ NO ₂	Y	Y	Y	N	7,4,0,2
103	α-Aminoisobutyric acid	C ₄ H ₉ NO ₂	Y	Y	Y	N	7,4,0,3
103	γ-Aminobutyric acid	C ₄ H ₉ NO ₂	Y	Y	Y	N	7,4,0,0
103	β-Aminoisobutyric acid	C ₄ H ₉ NO ₂	Y	Y	Y	N	7,4,0,2
105	Serine	C ₃ H ₇ NO ₃	Y	Y	Y	Y	7,4,0,2
105	Isoserine	C ₃ H ₇ NO ₃	Y	N	Y	N	7,4,0,2
111	Cytosine	C ₄ H ₅ N ₃ O	--	--	--	*	8,4,1,1
112	Uracil	C ₄ H ₄ N ₂ O ₂	--	--	--	*	8,4,1,1

115	Proline	C ₅ H ₉ NO ₂	N	N	N	Y	8,4,1,1
117	Norvaline	C ₅ H ₁₁ NO ₂	N	Y	Y	N	8,4,0,2
117	Valine	C ₅ H ₁₁ NO ₂	Y	Y	Y	Y	8,4,0,3
117	Isovaline	C ₅ H ₁₁ NO ₂	Y	Y	Y	N	8,4,0,3
119	Homoserine	C ₄ H ₉ NO ₃	N	N	Y	N	8,4,0,2
119	2-Methylserine	C ₄ H ₉ NO ₃	N	N	Y	N	8,4,0,3
119	Threonine	C ₄ H ₉ NO ₃	Y	N	N	Y	8,4,0,3
121	Cysteine	C ₃ H ₇ NO ₂ S	N	--	--	Y	7,5,0,2
131	Leucine	C ₆ H ₁₃ NO ₂	Y	N	N	Y	9,4,0,3
131	Isoleucine	C ₆ H ₁₃ NO ₂	Y	N	N	Y	9,4,0,3
132	Ornithine	C ₅ H ₁₂ N ₂ O ₂	N	N	Y	N	9,4,0,2
132	Asparagine	C ₄ H ₈ N ₂ O ₃	N	N	N	Y	9,4,0,2
133	Aspartic acid	C ₄ H ₇ NO ₄	Y	Y	Y	Y	9,4,0,3
135	S-Methylcysteine	C ₄ H ₉ NO ₂ S	Y	--	--	N	8,5,0,2
135	Adenine	C ₅ H ₅ N ₅	--	--	--	*	10,4,2,0
146	Glutamine	C ₅ H ₁₀ N ₂ O ₃	N	N	N	Y	10,4,0,3
146	Lysine	C ₆ H ₁₄ N ₂ O ₂	N	N	N	Y	10,4,0,2
147	Glutamic acid	C ₅ H ₉ NO ₄	Y	Y	Y	Y	10,4,0,3
149	Methionine	C ₅ H ₁₁ NO ₂ S	Y	--	--	Y	9,5,0,2
149	β-Hydroxyaspartic acid	C ₄ H ₇ NO ₅	N	N	Y	N	10,4,0,4
151	Guanine	C ₅ H ₅ N ₅ O	--	--	--	*	11,5,2,1
155	Histidine	C ₆ H ₉ N ₃ O ₂	N	N	N	Y	11,5,1,2
161	α-Aminoadipic acid	C ₆ H ₁₁ NO ₄	N	N	Y	N	11,4,0,3
161	2-Methylglutamic acid	C ₆ H ₁₁ NO ₄	N	N	Y	N	11,4,0,3
163	Ethionine	C ₆ H ₁₃ NO ₂ S	Y	--	--	N	10,5,0,2
165	Methionine sulfoxide	C ₅ H ₁₁ NO ₃ S	Y	--	--	N	10,5,0,3
165	Phenylalanine	C ₉ H ₁₁ NO ₂	N	N	Y	Y	12,5,1,2
174	Arginine	C ₆ H ₁₄ N ₄ O ₂	N	N	N	Y	12,5,0,3
181	Tyrosine	C ₉ H ₁₁ NO ₃	N	N	N	Y	12,5,1,3
181	Methionine sulfone	C ₅ H ₁₁ NO ₄ S	Y	--	--	N	11,5,0,2
183	Homocysteic acid	C ₄ H ₉ NO ₅ S	Y	--	--	N	11,5,0,3
204	Tryptophan	C ₁₁ H ₁₂ N ₂ O ₂	N	N	N	Y	15,5,2,2

Legend: Y = Species Found N=Species Not Found

“--” = Species not Targeted *=Nucleobase

Table 2: The Step-wise Result from the Harmonic Series Function

n	Step	Final
1	360.00	0.00
2	180.00	180.00
3	120.00	300.00
4	90.00	30.00
5	72.00	102.00
6	60.00	162.00
7	51.43	213.43
8	45.00	258.43
9	40.00	298.43
10	36.00	334.43
11	32.73	7.16
12	30.00	37.16
13	27.69	64.85
14	25.71	90.56
15	24.00	114.56
16	22.50	137.06
17	21.18	158.24
18	20.00	178.24
19	18.95	197.19

Table 2 illustrates the stepwise output of the Harmonic Series along with the running total Final summed angle result at each step. The important “n” values are those which represent a “Final” angle which approaches 180 or 360 degrees, representing the first 3 “nights” and “days” respectively in a literal 7-day Creation model.

Table 3: Relative Abundances of Amino Acids in the Murchison Meteorite and an Electric-Discharge Synthesis

TABLE 2. *Relative abundances of amino acids in the Murchison meteorite and an electric-discharge synthesis*

Amino acid	Murchison meteorite	Electric discharge
Glycine	4	4
Alanine	4	4
α -Amino- <i>n</i> -butyric acid	3	4
α -Aminoisobutyric acid	4	2
Valine	3	2
Norvaline	3	3
Isovaline	2	2
Proline	3	1
Pipecolic acid	1	<1
Aspartic acid	3	3
Glutamic acid	3	2
β -Alanine	2	2
β -Amino- <i>n</i> -butyric acid	1	1
β -Aminoisobutyric acid	1	1
γ -Aminobutyric acid	1	2
Sarcosine	2	3
<i>N</i> -Ethylglycine	2	3
<i>N</i> -Methylalanine	2	2

Mole ratio to glycine (= 100): 0.05–0.5, 1; 0.5–5, 2; 5–50, 3; >50, 4. The meteorite abundances are estimated from the published gas chromatogram (2); these estimates are approximate.

Table 2 and chromatogram (2) from Wolman, 1972.

Figure 1: The First Three Days of the Creation Correspond to the First Three Periods of the Periodic Table of the Elements

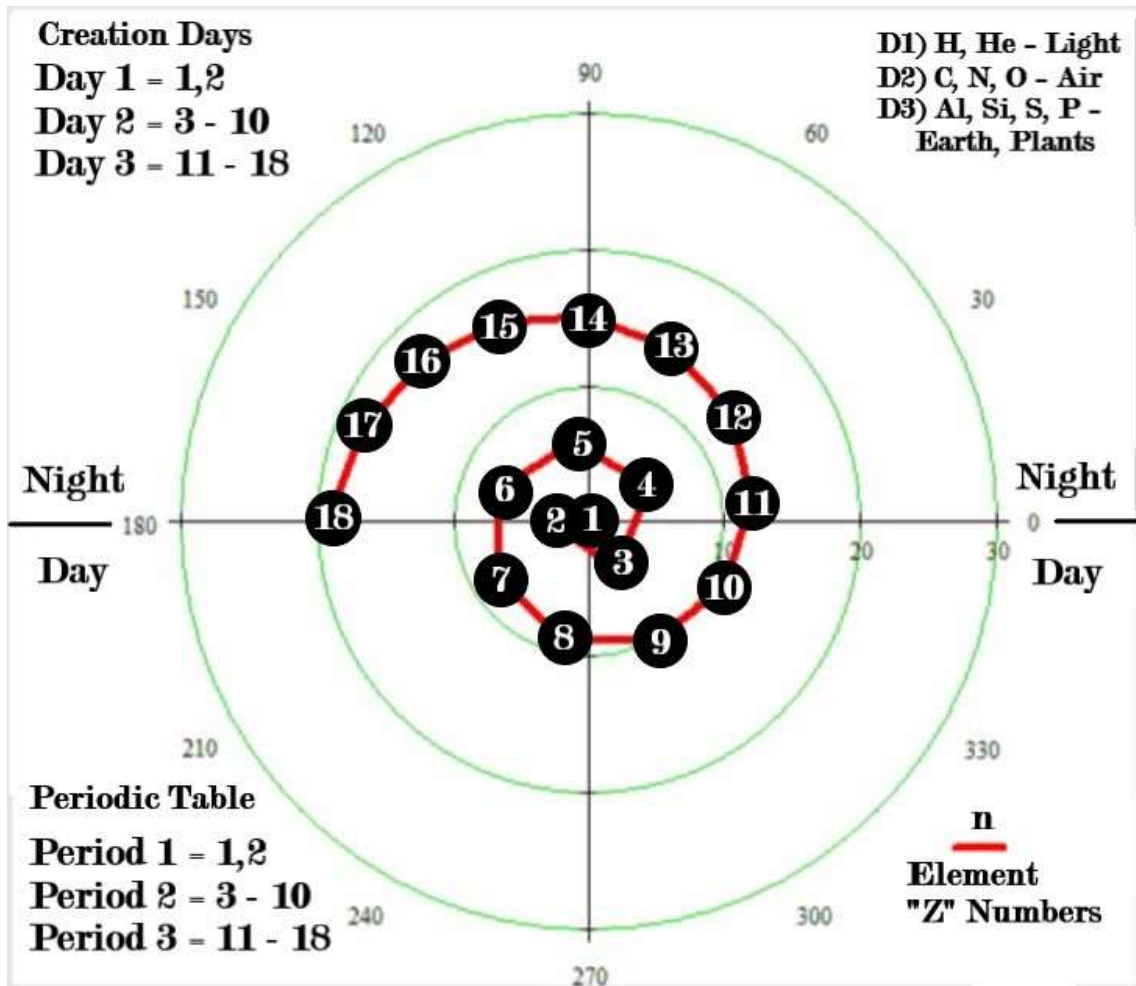


Figure 3 graphically illustrates the stepwise output of the Harmonic Series along with the running total Final summed angle result at each step. The important “n” values are those which represent a “Final” angle which approaches 180 or 360 degrees, representing the first 3 “nights” and “days” respectively in a literal 7-day Creation model. Notice how the first 3 Creation days qualitatively (D1-D3 above) and quantitatively correspond to the first 3 periods of the Periodic Table of the Elements.

Figure 2: Miller-Urey Classic Apparatus

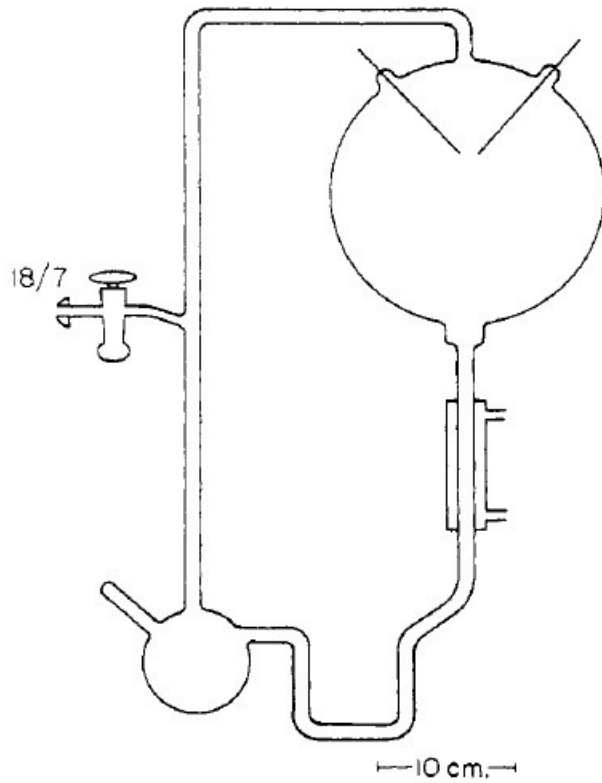


Fig. 1.—Apparatus no. 1.

The 1958 Miller-Urey “Classic” electric-discharge experimental apparatus. Boiling chamber shown in lower left, the spark chamber is upper right. The middle right item is the condenser. Image taken directly from the Miller paper.

Figure 3: Miller-Urey Volcanic and H₂S Apparatus

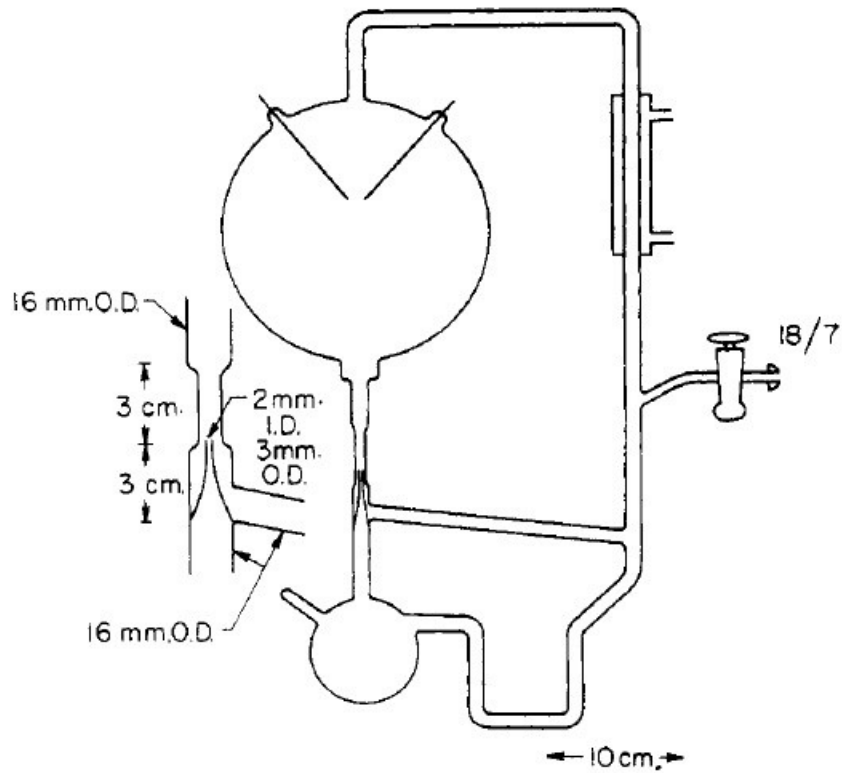


Fig. 2.—Apparatus no. 2.

The 1958 Miller-Urey “Volcanic” and “H₂S” electric-discharge experimental apparatus. Boiling chamber shown in lower left, the spark chamber is upper left. The upper right item is the condenser. Center tube from right to left leads to aspirator directly underneath the spark chamber to simulate steam from volcano. Additional information on aspirator is shown to the left of the reactor. Image taken directly from the Miller paper.

Figure 4: Miller-Urey Results--Classic Experiment



Chart of the Miller-Urey “Classic” results. The largest amino acid found was Glutamic acid with a molecular weight of 147 Da. The Miller-Urey yield data (green) shows an exponential trendline which extrapolates a 1nmol cutoff of 164 Da. The red trendline is the Chemical Space Model, which gives a 1 nmol “zero” crossing of 170 Da. The Chemical Space Model has a 72% correlation with the “Classic” yield data. Note that the Chemical Space Model data was normalized to Glycine = 1.

Figure 5: Miller-Urey Results--Volcanic Experiment

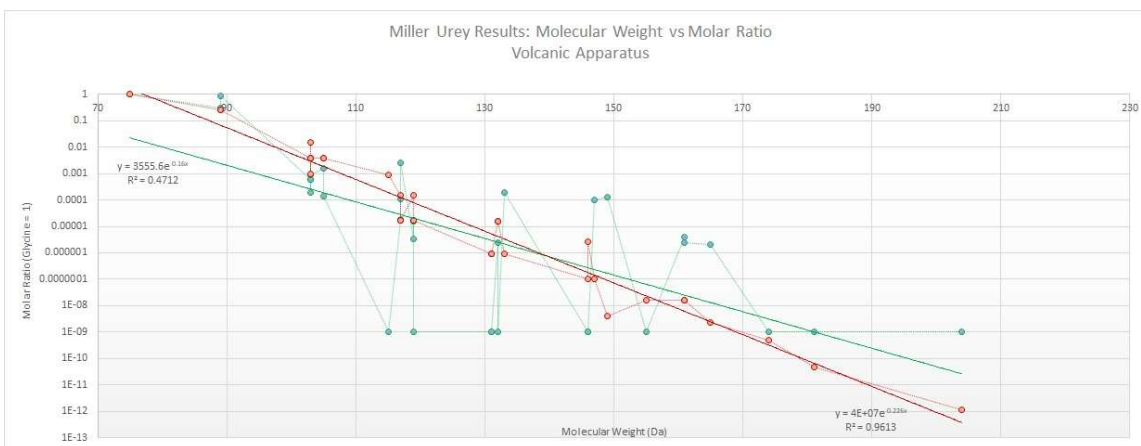


Chart of the Miller-Urey “Volcanic” results. The largest amino acid found was phenylalanine with a molecular weight of 165 Da. The Miller-Urey yield data (green) shows an exponential trendline which extrapolates a 1nmol cutoff of 180 Da. The red trendline is the Chemical Space Model, which gives a 1 nmol “zero” crossing of 170 Da. The Chemical Space Model has an 72% correlation with the “Volcanic” yield data. Note that the Chemical Space Model data was normalized to Glycine = 1.

Figure 6: Miller-Urey Results--H₂S Experiment

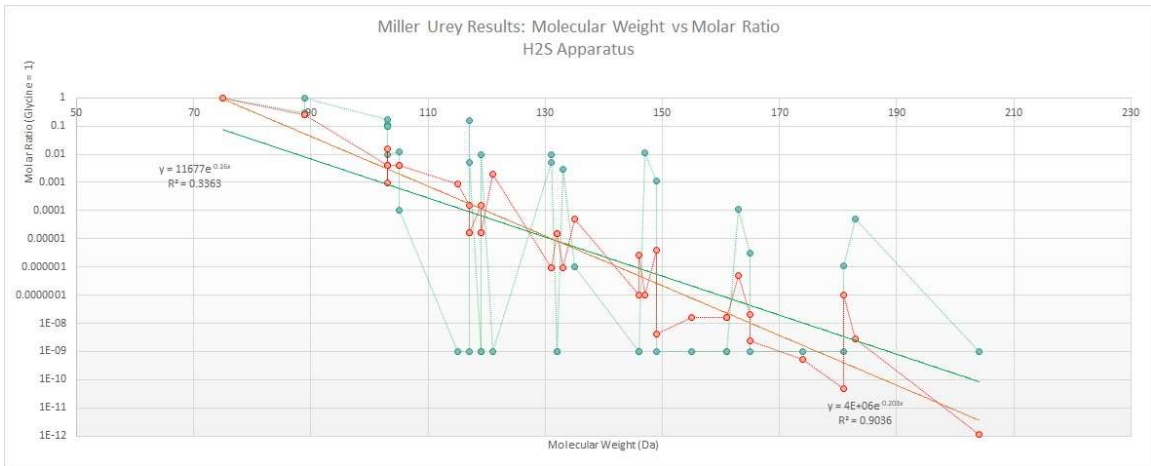
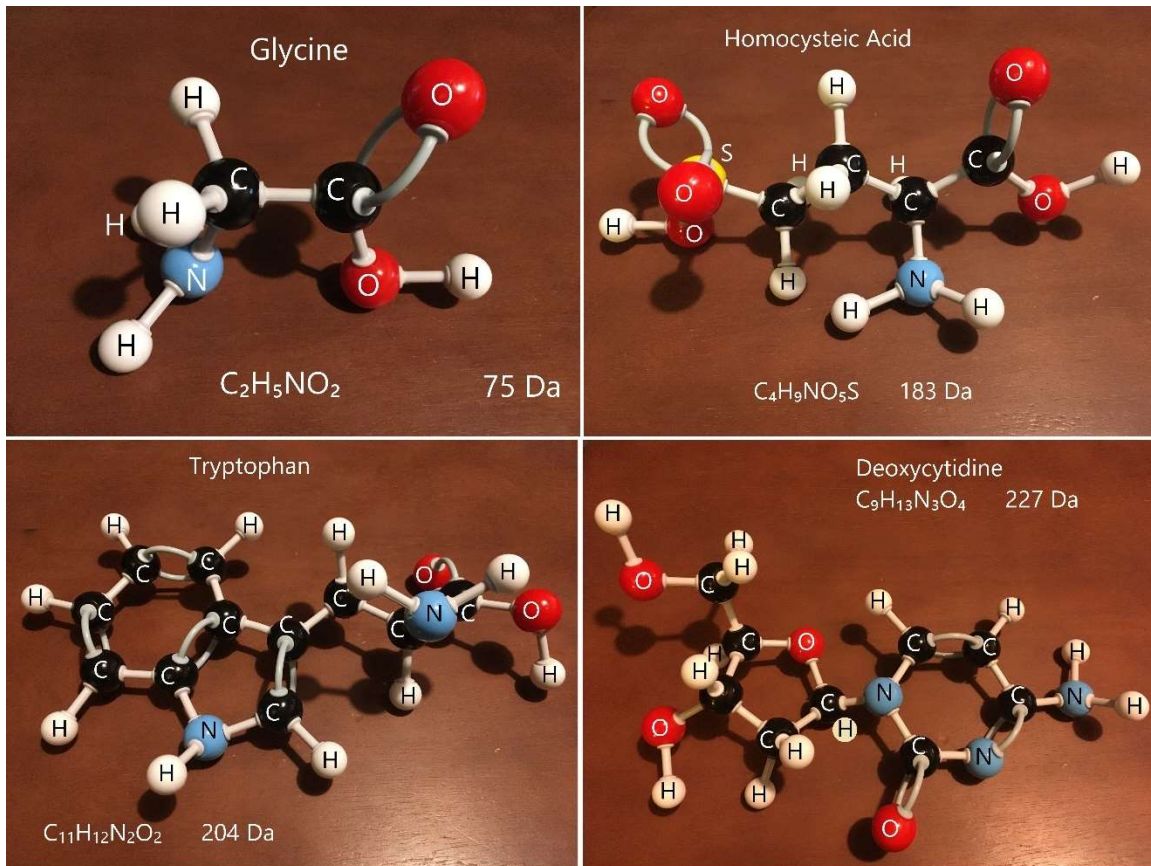


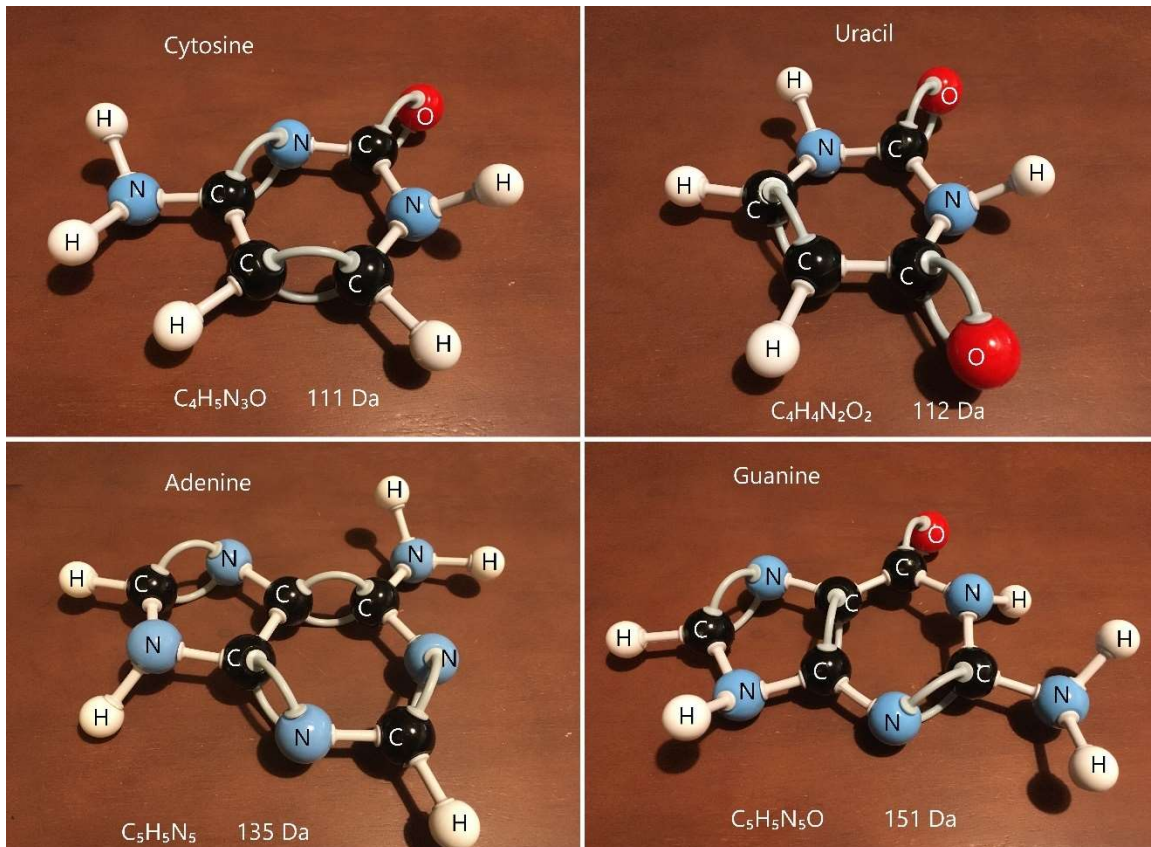
Chart of the Miller-Urey “H₂S” results. The largest amino acid found was homocysteic acid with a molecular weight of 183 Da. The Miller-Urey yield data (green) shows an exponential trendline which extrapolates a 1nmol cutoff of 188 Da. The red trendline is the Chemical Space Model, which gives a 1 nmol “zero” crossing of 177 Da. The Chemical Space Model has a 61% correlation with the “H₂S” yield data. Note that the Chemical Space Model data was normalized to Glycine = 1.

Figure 7: Biological Molecules--A Comparison



“Stick and Ball” models of the amino acids targeted for the Miller-Urey experiments. The figure shows the increasing stereochemical complexity of the molecules, especially as molecular weight increases. Glycine was the smallest species found. Homocysteic Acid was the largest. Tryptophan was not found in the Miller-Urey results, and is the largest biological amino acid, shown here for comparison. Deoxycytidine is the smallest nucleoside at 227 Da, and is shown here directly below Homocysteic Acid for comparison purposes to show the complexity increase of the largest molecule found at 183 Da.

Figure 8: Nucleobases--A Comparison



“Stick and Ball” models of the biological nucleobases show the increasing complexity of the molecules, especially as molecular weight increases. All four molecule exhibit aromatic ring structures which require specialized non-destructive chemical analysis techniques to isolate.

Figure 9: Comparing Miller-Urey Classic and H₂S Results to Murchison and Lonewolf Nunataks Chondrites

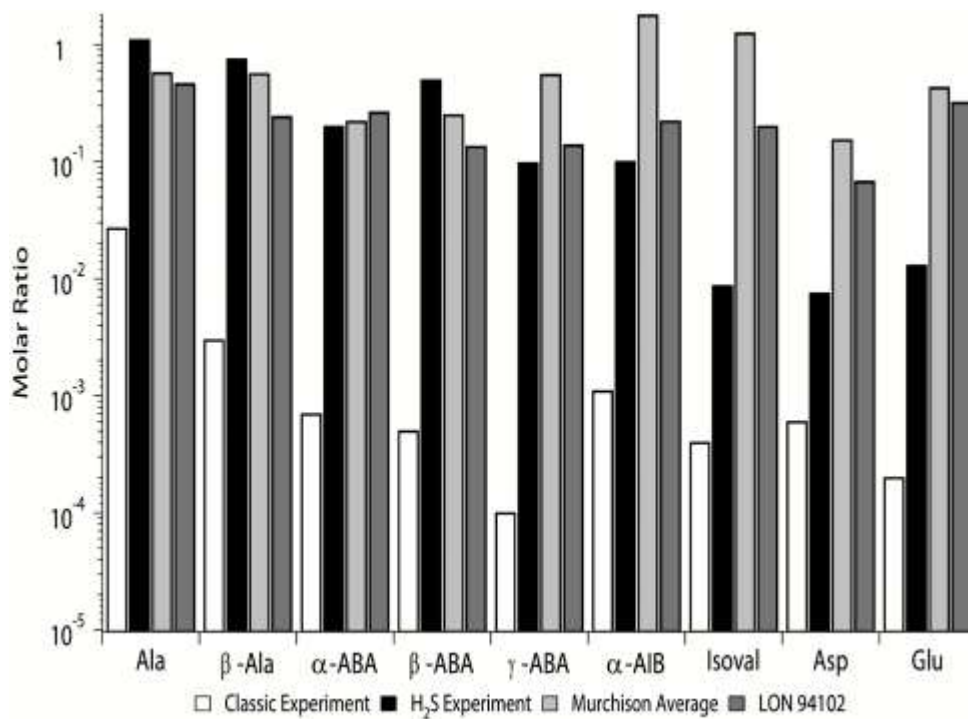


Image above shows that amino compounds isolated from multiple Murchison Meteorite samples and Antarctic samples are commensurate with Miller-Urey results, even though these Extra-Terrestrial objects have been in existence for billions of years, undergoing varied temperature conditions as they travel through space. (Graph from the Parker et al. 2008)

Figure 10: Comparing Miller-Urey H₂S Results to Antarctic CR Chondrites

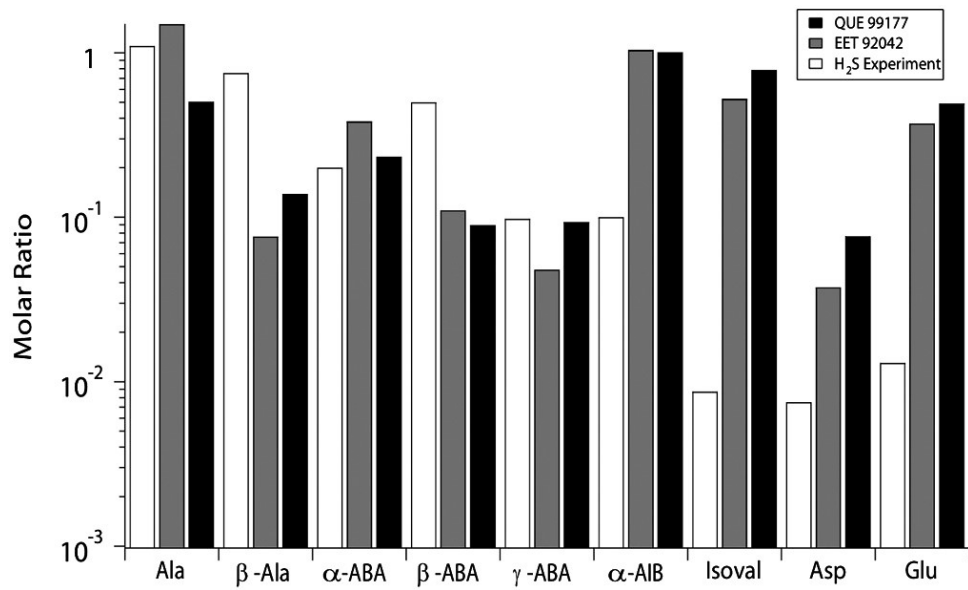


Image above shows that amino compounds isolated from multiple Antarctic samples are commensurate with Miller-Urey results, even though these Extra-Terrestrial objects have been in existence for billions or years, undergoing varied temperature conditions as they travel through space. (Graph from the Parker et al. 2008 “Supplemental Information”)