“What’s the Problem with the Evolution of Amino Acids?”

Dr. Bohlin,

I have heard you describe on “Point of View” the probability of amino acids forming proteins on their own as being astronomical. Can you direct me to an article or will you briefly describe to me why covalence is not a possibility when considering the formation of amino acids and eventually proteins?

There are two primary problems for the origin of proteins on the early earth. The first is chemical and the second is informational.

The chemical problem arises from the nature of the peptide bond which links amino acids in proteins. In linking the carboxyl group of one amino acid to the amino group of the other, a molecule of water is released. Since almost all early earth scenarios take place in the presence of water, the high concentration of water will prevent the linkage from taking place. The high energy needed to cast off a molecule of water in an aqueous solution is very high. Cells overcome this barrier through the action of the ribosome, a combination of RNA and several proteins which allows the linkage reaction to take place in a protein fold devoid of water. But in the early earth there are no proteins or RNA.

The informational problem arises from the fact that not every sequence of amino acids is useful for life-giving processes. Current estimates suggest that as many as 200 different proteins are necessary for life. Each of these proteins requires a specific sequence of amino acids in order to function. One calculation that has been verified experimentally, shows that a 100 amino acid protein requires a

specificity of sequence that has only a 1 in 10 to the 65th power probability of occurring by chance alone. This even allowed for most amino acids to be substituted by similar amino acids in the sequence. So one not only has to manufacture one protein but hundreds, and then bring them together in a membrane like structure, in order for life to take hold. The odds are enormous.

One other problem is also chemical. Amino acids are among the many organic compounds (made of carbon, hydrogen, and oxygen) that exist in two different structural forms called stereoisomers. One form will rotate polarized light to the left (left-handed) and the other will rotate polarized light to the right (right-handed). When amino acids are formed chemically, that is apart from a living system, both forms are produced in equal numbers. However, the amino acids of proteins from living organisms are almost exclusively left-handed. No one knows of a chemical process to achieve this result.

A good technical summary of this and other problems can be found in Thaxton, Bradley and Olson's *The Mystery of Life's Origin*. Probe makes this book available on our website for $10.

Respectfully,

Ray Bohlin
Probe Ministries

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“Aren’t the Bonds in Peptides More Easily Formed?”

Dr. Bohlin: I have been in contact with a good friend and we have been having a wonderful discussion regarding a series of topics centering around intelligent design. As typical of our conversations we tend to head down tangential trails that avert our focus momentarily. This week’s parley has to do with chemical bonding as associated with protein synthesis. Specifically, your position that the probability of amino acids forming proteins on their own is astronomical. My friend sent you an email recently asking why covalence is not a possibility when considering formation of amino acids and eventually proteins. In your response you referred to two primary problems: chemical and informational. In regards to the chemical you briefly stated that using the early earth scenario (where earth scientists envision a watery world) the energy required to release the water molecule during the peptide bonding process is high especially in an aqueous solution. Further, you state that this barrier can be overcome by the cell through the use of ribosome in a protein fold devoid of water but that the early earth had no RNA to overcome this barrier. Here is my long drawn out question to you.

First, I contend that the weak hydrogen bond (not covalent) associated with the loss of the two hydrogen and one oxygen atom during the formation of an amino acid with the peptide bond is easily broken through a heat catalyst such that existed during the high radioactive decay of the early earth as it cooled from its molten stage (and still does today but to a much lesser degree). This loss of a water molecule would heighten the affinity of the amino acid to the peptide bond thus strengthening their mutual attraction. The early earth model also indicates that pH (percent hydrogen) levels were

probably very different which would also act as a catalyst to break the hydrogen bond as the hydrogen and oxygen atoms try to degas from solution and neutralize the solution. The earth's closed system perpetuated this process indefinitely by trapping the heated gases laden with other hydrous compounds such as sulfuric acid. The formation of the amount of water on earth certainly could not be accomplished by the release of water molecules through the formation of proteins alone. This begs the question of which came first the chicken or the egg? If it were the amino acids, then we would have a sea of amino acids greater than the volume of the oceans. If the amino acids were formed outside of an aqueous solution then where did the water molecules come from that were eventually released? Both hydrogen and oxygen had to be abundantly present and together they form many, many more molecules other than just amino acids and water. The information concern you were referring to suggests that 10 to 65th power is unobtainable. However, when there exists many times more that number of amino acids the odds quickly reduce and become more favorable. 10 to the 65th sounds astronomical but 10 to the 6500th is even more astronomical thus diminishing the former. Further, amino acids can be synthesized in the laboratory which suggests that the building blocks are present on earth. In time, with the correct agents in place (such as powerful radioactive isotopes {neutrinos perhaps?}) the left-handed stereoisotopes of amino acids may also be laboratorily synthesized.

Finally, I would like to know your thoughts on why you believe that proteins were designed. Is it purely philosophical or have you developed a hypothesis that has been tested by others that lends further credence to your postulation? Thank you for your time in advance.

Thank you for your consideration of my earlier response and I am glad to answer your questions and objections.

First, the bonds that are broken to form a peptide bond

formation with the subsequent release of water are not hydrogen bonds, they are covalent. That is why peptide bond formation is endothermic or uphill in relation to energy. Simply providing heat is not going to overcome this problem. Sydney Fox attempted thermal synthesis of proteins in early earth conditions, the results of which he termed proteinoids. Beginning with amino acids (in solution or dry) he heated the material at 200 degrees C for 6-7 hours. The water produced by bond formation (and any original water from the aqueous solution) is evaporated. The elimination of water makes a small yield of polypeptides possible. The increased temperature plus the elimination of water makes the reaction irreversible. However, this process has been rejected for four reasons. First, in living proteins only alpha peptide bonds are formed. In Fox's reactions, beta, gamma and epsilon peptide bonds are also found in abundance. Second, these thermal proteinoids are composed of both L and D amino acids. Only L amino acids are found in living proteins. Third, these are randomly sequenced proteins with no resemblance to proteins with catalytic activity. "Fourth, the geological conditions indicated are too unreasonable to be taken seriously. As Folsome has commented, 'The central question [concerning Fox's proteinoids] is where did all those pure, dry, concentrated, and optically active amino acids come from in the first place.'" (*Mystery of Life's Origin*, 1984, Thaxton, Bradley, and Olsen, p. 155-156)

I am sorry you got the impression that I believed that the formation of peptide bonds and the concomitant release of a water molecule produced the original water on the planet. That is not the nature of the chicken or egg dilemma. The chicken or egg dilemma refers to the fact that in living systems today, proteins are required for DNA and RNA to function with specificity. Histones are required to maintain DNA folding structure and more importantly, proteins are required for DNA and RNA replication. However, it is the DNA which contains the code for the construction of proteins. DNA needs proteins,

proteins need DNA. Which came first in the early earth? DNA or protein, chicken or egg? The proposed RNA world, RNA molecules which can perform some limited enzyme (protein) functions is negated by the fact that there is no mechanism for the production of RNA in an abiotic early earth. Even if this is accomplished, the enzyme-like functions of some small RNA molecules are not sufficient to support life in any shape or form.

Just because 1/10 to the 65th power is large compared to 1/10 to the 6,500 power does not minimize 1/10 to the 65th as a very small probability. It is estimated that there are 10 to the 80th power particles in the universe. The smallest amino acid, glycine is comprised on 13 atoms, each atom (either hydrogen, carbon, nitrogen or oxygen) is composed of multiple protons, electrons and neutrons and each of these is composed of multiple quarks. You can readily recognize that a sea of 10 to the 65th amino acids is a physical impossibility. Current estimates suggest that the concentration of amino acids in the early earth could never have exceeded, 10 to the -7 molar, which is the same as the present Atlantic Ocean (*Mystery of Life's Origin* cited earlier, p. 60). Sheer numbers are not going to help. Most researchers rely on some form of concentration mechanism to get enough amino acids together for protein formation. Even when this happens, many of the same problems that Fox's experiments run into are difficult to eliminate.

Finally, I believe that proteins are designed for both philosophical and scientific reasons. Proteins as stated earlier, contain information. The sequence of the 20 different amino acids in a protein consisting of 100 amino acids is crucial to its function. William Dembski (in the *Design Inference*, Cambridge University Press, 1999 and *Intelligent Design*, Intervarsity Press, 2000) rigorously defines this information as complex specified information or CSI. It is complex because the sequence of a protein is not a simple

repetition as in a nylon polymer. And it is specified because it can tolerate only a small range of substitution at any one of the 100 positions, indeed at some positions, no substitution can be tolerated. Summing these up is where the 10 to the 65th power came from.

Most biologists readily admit today that chance alone is incapable of overcoming these odds. Therefore, they hold out for some undiscovered natural law that will allow information to arise out of the chaos of a mixture of amino acids. But law is also an unlikely candidate. Some have suggested that perhaps certain amino acids have an affinity for certain other amino acids. This could give some level of sequence specificity. This fails on two counts. First no such pattern is observable when nearest neighbors are analyzed in modern proteins. Second, this would defeat the entire process since the sequence would no longer be complex but simple. Simple because the sequence could now be predicted once the first amino acid is put in place. This would lead to a very limited number of possible combinations and not the millions of possibilities currently residing in living cells.

The only known source for CSI today is intelligence. Even the fundamentalist Darwinian Richard Dawkins, said in his book *The Blind Watchmaker*, "Biology is the study of complicated things that give the appearance of having been designed for a purpose." Perhaps they appear to be designed because they were designed. There is certainly nothing unscientific about wanting to explore that possibility.

Respectfully,

Ray Bohlin
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