To address the likelihood of the existence of hybrids, or beings who are the product of a member of the Homo sapien species and an extraterrestrial species, a probabilistic equation similar to the Drake Equation, was developed. The equation parameters address the likelihood of extraterrestrials having a specific type sugar; amino acid; codon; chromosome; and, cell membrane structure as our own species.

The Geller Equation:

On the Probability of Successful Sexual Relations with Extraterrestrials

Harold A. Geller

INTRODUCTION

In 2010, Dr. Stephen Hawking was quoted in the British paper, the Sunday Times. [Leake, 2010] The gist of what Hawking said was that the human species should not try to communicate with any extraterrestrial intelligence off of this planet Earth; because, he thought the results would be catastrophic. In response to his statements in the Sunday Times, the Journal of Cosmology asked for community response to Hawking's views. The journal published letters from fourteen scientists regarding Hawking's opinions. [Commentaries, 2010]

Among the 14 published commentaries 5 (36%) outright agreed with Hawking's statement that humans should not try to contact extraterrestrials. Only 3 (21%) outright disagreed with Hawking's view regarding contact. Finally, 6 of the 14 (43%) preferred to refrain from a direct agreement or disagreement. They preferred to contemplate the possible scenarios, especially the view that contact would not be with intelligent extraterrestrials, rather with microbial extraterrestrials.

Two of the responding commentators to the Journal of Cosmology highlighted the Drake equation. There are many alternative forms attributed to the Drake Equation. [Drake, 1965] In 1992, while at the National Radio Astronomy Observatory in Green Bank, West Virginia, a picture was taken of a plaque outside the meeting room where Frank Drake and some colleagues met to discuss such a formula. [Geller, 2014] Figure 1 shows their original formulation of what is today known as the Drake Equation.

Figure 1 – Drake Equation original formulation as noted by commemorative plaque.
Photo by H. Geller

After examining all of the individual components of the Drake Equation, one tends to conclude that the resultant number of communicative extraterrestrial civilizations in the Milky Way galaxy is approximately equal to value assigned for the lifetime of such a communicative civilization itself. That is because this particular parameter has the most sensitivity to variances in the quantity. [Geller, 2014]

The average lifetime of a civilization has optimistically been estimated to be about 300,000 years. [Kompanichenko, 2000] However, historians tend to be more pessimistic and have estimated this value to be about 400 years. [Freeman, 2016] The historians use the lifetimes of ancient civilizations across the continents from Africa to Central America. There is a urban legend that attributes Alexander Tytler with deriving a value of 200 years. [Collins, 2009] In any event, with the distances that may exist between any of these number of civilizations to be on the order of thousands of light years, cross pollination of civilizations is not likely.

Again, by using the Drake Equation approach, we are limiting our calculations to this Milky Way galaxy. We should not forget this result does not encompass the estimated trillion galaxies in the observable universe. [Conselice, 2017]

Another response to the statements made by Stephen Hawking in 2010 was a volume with an antithetical title of *Extraterrestrial Altruism: Evolution and Ethics in the Cosmos*. [Vakoch, 2013] Within this edited volume are the musings of 18 authors from numerous walks of life; all concluding that the fears of Hawking are unwarranted. In particular, we find the beginnings of a probabilistic equation related to the probability of the biochemistry of any extraterrestrial. [Geller, 2013] These stated probabilities led to the development of another probabilistic equation which starts with the results from the Drake Equation and concludes with the probability of any extraterrestrial encounter leading to the development of offspring of a hybrid nature.

BEYOND THE DRAKE EQUATION DISCUSSION

On October 1, 2016, the British publication called the Express, published an article about a number of women who claimed to have had sexual relationships with extraterrestrial life forms. In fact, these women believed that the sexual relations led to the birth of hybrid humans, half human and half extraterrestrial. The author of the story goes on to discuss a group of people who have established a major World Wide Web presence. That which binds all these people of such organizations is that they believe that they, or their parents, were not only abducted by extraterrestrials, but the sexual relations that took place led to viable hybrid individuals. [Austin, 2016]

Another name for such hybrid individuals is transgenic human. In fact, there is even an attempt to describe how easy it could be to make such an individual. We will not go into the details as provided by these organizations and their webpages. We will note that those who are seriously investigating such claims purport to have over 300 publications that back up their studies. [Rowell, 2017]

We wish to address here the probability that an extraterrestrial individual could actually succeed in producing a viable hybrid individual. To this end we sought to develop an equation in the same genre as the Drake Equation; that is, we use a series of

probabilities and statistics to generate the likely number of extraterrestrial life forms that could possibly have successful sexual relations with Homo sapiens.

$$S_x = N \bullet f_s \bullet f_{aa} \bullet f_{cod} \bullet f_{chr} \bullet f_{mem}$$

In this equation, S_x is the number of ETI civilizations with whom humans could have viable offspring as a result of sexual relations. N is the number of civilizations in the Milky Way Galaxy with advanced technologies; that is, the resultant of the calculation completed for the Drake Equation. Now we introduce f_s as representing the fraction of ETIs with dextro sugar stereo-isomers; f_{aa} as the fraction of ETIs with levo amino acid stereo-isomers; f_{cod} as the fraction of ETIs with same codon interpretation as Homo sapiens; f_{chr} as the fraction of ETIs with same chromosomal number as Homo sapiens; and, f_{mem} as the fraction of ETIs with the same cell membrane structure as Homo sapiens so as to allow cell membrane (i.e. egg) penetration.

Now let us determine the assignment of values for the parameters of the S_x equation. Many astrobiologists use the value of 10,000 for N or the number of communicative civilizations in our Milky Way Galaxy. So let's utilize allow N a value of 10,000. [Wandel, 2015]

With respect to a reasonable value for f_s we suggest 0.5. There are only two possible stereoisomer families that could be found, so one half is the probability that an ETI individual has the same as we possess, or f_s is 0.5. We often overlook the fact how crucial it is to have the correct stereoisomer or enantiomers of all of the sugars that are vital in the Krebs Citric Acid Cycle. [Zubay, 2000] Figure 2 and Figure 3 show 3D molecular models of stereoisomers. Figure 2 is of bromochloroethane and Figure 3 of the amino acid alanine. We next deal with the amino acids in life on Earth, especially Homo sapiens.

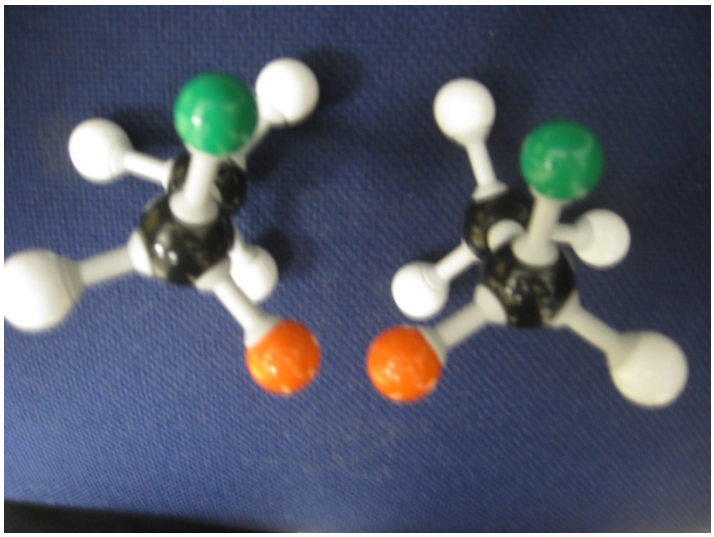

Figure 2. Stereoisomers of bromochloroethane. [Credit: H. Geller]

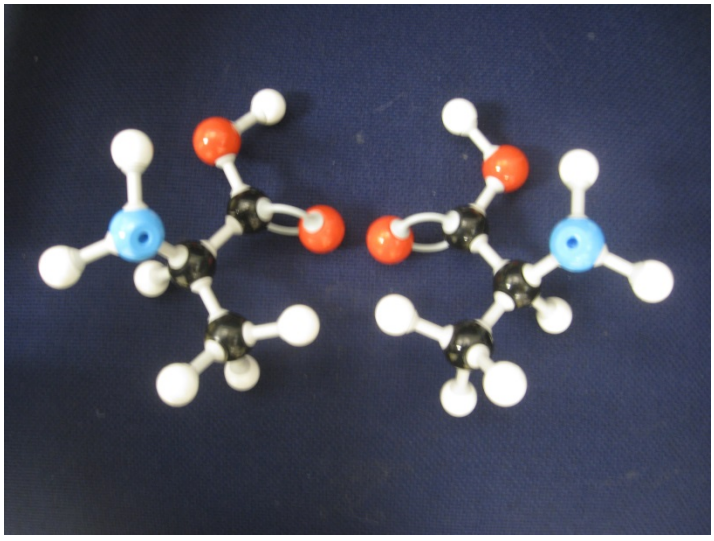

Figure 3. Stereoisomers of alanine. [Credit: H. Geller]

For f_{aa} or the fraction of ETIs with the same 20 levo amino acid stereo-isomers utilized the probability of having the same stereoisomers also 0.5, multiplying by the probability of the same 20 amino acids used in Homo sapiens is 20/60 times 40 factorial over 60 factorial, leading to a combined probability of 8.17×10^{-36}.

Now to f_{cod} or the fraction of ETIs with same codon interpretation as Homo sapiens. There are three nucleic acids in a codon and four possibilities for each position in the codon. That would give us four to the third different permutations, or 64. However, this assumes that the number of nucleic acids in any individual is precisely 4. The likelihood of the same nucleotide sequence is based upon the number of nucleotides. While every cell on the planet Earth may only make use of 4 nucleotides, there are 8 known nucleotides. That leads to a probability of getting the correct nucleotide as being $(1/8)^3$ or 1/512. So the probability of getting the correct nucleotide sequence, again assuming

the codons are interpreted the same in both Homo sapiens and the extraterrestrial species is 1/6144.

Now for f_{chr} which is the fraction of ETIs with the same number of chromosomal pairs as Homo sapiens. In one study of a metadata analysis of the number of chromosomal pairs among 194 different species on Earth, only 1.5% of these had the same number as Homo sapiens. If we use one estimate of the number of species on Earth as 10 million (some go as high as 10 to 100 times that number); and, we use a similar percentage of those who have the same number of chromosomal pairs as Homo sapiens, we would conclude that there are some 150,000 species on Earth with a similar number of chromosomal pairs as Homo sapiens. In the end we may assign f_{chr} with a value of 0.015. [Reid, 2002]

Finally we get to f_{mem} as the fraction of ETIs with the same cell membrane structure as Homo sapiens so as to allow cell membrane (i.e. egg) penetration by an extraterrestrial sperm. It is estimated that among an approximate one million human sperm to approach an unfertilized egg, only one will ultimately succeed in penetrating the cell membrane, which is itself enveloped with a protective protein layer, and, fertilized the egg. It is not a minor feat. Evolution has provided human sperm cells with special features. [Birkhead et al., 2009]

CONCLUSION

Based upon this rudimentary formulation for the probability of successful reproduction of Homo sapiens by any extraterrestrial life form, it is a wonder how so many members of the species can claim to have produced offspring who are hybrid individuals of a human and extraterrestrial being. Using available statistics and probability assignments, we have seen that the likelihood of such successful sexual relations between humans and extraterrestrials is much less than that of winning the nationwide lottery, which is anywhere from 1 in 14 million to 1 in 200 million, depending upon the number of tickets sold. This represents about a probability of 5×10^{-9}. Our resultant probability for the extraterrestrial sex equation is less than 6.3×10^{-42}. As noted by Cham and Whiteson (2017), "things with infinitely small probabilities occur exactly once." That is, it is most likely that we are the only examples of Homo sapiens in our galaxy; and, no sexual relations between a human and an extraterrestrial could ever produce viable offspring.

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