Does Only Life Begets Life

Does only life begets life? / also Lucky break science & God of the gaps

For an excellent history about the origin of this question read the following article that was published in the July-August edition ofAmerican Scientist. (vol 98 no 4)

http://www.americanscientist.org/issues/pub/winter-1859)

The following important quotes from the article indicate the present view of the main stream biologists:
(i)" *Pasteur, of course, was right, but with one major exception. If we think of contemporary organisms I n the present, life begets life. But if we look into the past, we quickly realize that there must have been at least one time when Pasteur's dictum did not hold. Some 3.8 to 4 billion years ago, life on Earth emerged from nonlife."*

(ii) "Existing organisms have in effect evolved to evolve, balancing their mutation rates to the vagaries of the environment and the costs and benefits of the accurate copying of genetic information."

What did we discover since Paateur over the 150 plus years since 1859?

I) Stanley Miller's important experiments published 1953. indicated that pre biotic era (before life) earth was able to synthetized amino acid.

Similar experiments followed and not only amino acids but also sugars , purines and pyrimidines could be synthetized on the pre biotic earth. The primitive earth was able to produce the buiding pblocks of earth.

II) James Watson and Francis Crick discovered the structure of the DNA molecule. (also 1953)

The expectation was high in the scientific community that humans were at the brink of solving the mystery of life's origin., how non living molecules became living chemistry.

III)During the nineties (1990s) it became clear that it wasn't going to be easy.

Let us see what Stanley Miller realized during the mid 1990s. He was co-author of the follwing articles:

http://www.pnas.org/content/92/18/8158.full.pdf

(copy and paste the URL (web address) in your Browser's address bar)

and

http://www.cell.com/cell/abstract/S0092-8674(00)81263-5?_returnURL=http%3A%2F%2Flinkinghub.elsevier.com%2Fretrieve%2Fpii%2FS0092867400812635%3Fshowall%3Dtrue

(Click full text just underneath the title info)

Important quotes from these articles:

"*The existence of the RNA world, in which RNA acted as a catalyst as well as an informational macromolecule, assumes a large prebiotic source of ribose or the existence of pre-RNA molecules with backbones different from ribose-phosphate. The generally accepted prebiotic synthesis of ribose, the formose reaction, yields numerous sugars without any selectivity. Even if there were a selective synthesis of ribose, there is still the problem of stability*."

"

CONCLUSION

The above results show that stability considerations preclude the use of ribose and other sugars as prebiotic reagents except under very special conditions. It follows that ribose and other sugars were not components of the first genetic material and that other possibilities, such as the peptide nucleic acids (36) and other non-sugar-based backbones, should be examined."

"In the last few years, there have been a number of developments in origin of life studies that merit review. We will discuss primitive atmospheres, submarine vents, autotrophic versus heterotrophic origin, the RNA and pre-RNA worlds, and the time required for life to arise and evolve to cyanobacteria"

"If it is assumed that life arose in a prebiotic soup containing most, if not all, of the necessary small molecules, then there was a large potential energy supply available on the primitive Earth from different fermentations. It is clear that such compounds could provide both the growth and energy supply of a large number of organisms, but this would rapidly result in the depletion of the available nutrients"

"Glucose unlikely that large quantities of this sugar were available in the primitive environment because of its instability."

"It is likely that the widespread belief that the origin and early evolution of life were slow processes requiring billions and billions of years stems from the classical Darwinian approach that major changes are slow and proceed in a stepwise manner over extended periods of time. All the evidence reviewed here suggests that stability of monomers and polymers essential for the origin of life strongly limited the possibility of a slow

emergence of life."

Miller et al also highlighted the chirality and enantrometic cross inhibition problems.

"*The instability problem could be overcome if the ribose nucleosides could have formed early, because nucleosides are quite stable owing to the absence of free aldehyde in its sugar. However, there is no efficient prebiotic synthesis of purine ribosides and no prebiotic synthesis of pyrimidine nucleosides at all. Added to these problems is the fact that any prebiotic synthesis of ribose or nucleosides would give a racemic mixture, and all template polymerization experiments so far show enantiomeric cross inhibition*. "

IV) The instability of building blocks and macromolecules
The previous Miller co-author , articles also mentioned it , but Lindahl was the first major researcher to tackle the problem of DNA 's instability. Also conirmed by other researches. This instability and the understanding of how life's chemistry counteracts it ;let to the 2015 Noble Prize for chemistry. Read the press release here

https://www.nobelprize.org/nobel_prizes/chemistry/laureates/2015/press.html

Important quote from this press release

"*In the early 1970s, scientists believed that DNA was an extremely stable molecule, but Tomas Lindahl demonstrated that DNA decays at a rate that ought to have made the development of life on Earth impossible*"

V) The chirality problem is still with us in spite of intensive research.

Two reseach papers from a very large data base were selected to illustrate the magnitude of this problem.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2857173/

Quote ". *The scientific driving force for this work arises from an interest in understanding the origin of life, because the homochirality of biological molecules is a signature of life*.".

"*Whether or not we will ever know how this property developed in the living systems represented on Earth today, studies of how single chirality might have emerged will aid us in understanding the much larger question of how life might have, and might again, emerge as a complex system*."

Blackmond discuses ways of how homochorality might have devloped, but she neglected the instability question and also refer to “chance “ and “ lucky breaks” . Is chance and lucky breaks part of scientific vocabulary ?

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4239201/

Excellent research but one big problem, Check Sczepanski and Joyce’s materials used to obtain their results. They used many chemicals that were definitely not part of the pre biotic primordial earth and therefore the theorem that only life begets life was not violated. There is no indication how a cross-RNA polymerase ribozyme would have developed on the pre-biotic earth..

VI)The Genetic code

Review of the code by Eugene V. Koonin* and Artem S. Novozhilov

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3293468/

“*Summarizing the state of the art in the study of the code evolution, we cannot escape considerable skepticism . It seems that the two-pronged fundamental question: “why is the genetic code the way it is and how did it come to be?”, that was asked over 50 years ago, at the dawn of molecular biology, might remain pertinent even in another 50 years. Our consolation is that we cannot think of a more fundamental problem in biology*.”

http://journals.plos.org/plosone/article?id=10.1371%2Fjournal.pone.0072225

“The genetic code shapes the genetic repository. Its origin has puzzled molecular scientists for over half a century and remains a long-standing mystery. Here we show that the origin of the genetic code is tightly coupled to the history of aminoacyl-tRNA synthetase enzymes and their interactions with tRNA. “

“n order to support this claim we focused on the expected impact of dipeptide synthesis on the peptide bond (dipeptide) makeup of protein structures (Figure 5). Dipeptides provide unique signatures of fold structure [44] with predictive power matching that of domains [45]. However, to avoid modern evolutionary effects of domain recruitment and rearrangements and discoun t possible structural ambiguities, we selected 2,384 single domain proteins with 1,475 FF assignments from our initial set of 204,531 structural entries.

This allowed accurate tracing of dipeptides in high-quality structural models. Simple heat map representations show amino acid monomer and dipeptide composition for every FF mapped along the timeline "

Another quote

" *Three of the other 6 amino acids (Gly, Glu and Asp), together with Ala, Val, Ile, Leu, were highly represented in the Urey-Miller experiments [47] and are considered prebiotically abundant and prone to prebiotic dipeptide formation* "

COMMENT : … but could lead to a shortage of the " l" mentioned amino acids if thy are effectively being incorporated in dipeptides.. (if the demand exceeds the supply, a shortage of the desired commodity develops. Refer also to Miller's 2nd article referred to previously- depletion of nutrients)

An excellent article but Caetano-Anollés neglected the chiralidy question. Their proposed evolutionary process depents on d- ribose, d-tRNA ,l-amino acids , l- dipetides and i-polipeptides.

Another important point neglected by Caetano-Anollés et al is the unstable code carriers. When developing a code and code commands a stable code carrier is necessary to prevent loss of memory and code deterioration .

VII) **Is there a minimum amount (a minimum size genome) necessary for life to prosper?**

http://science.sciencemag.org/content/351/6280/aad6253.full?ijkey=77AGRUAdvXIP2&keytype=ref&siteid=sci

Quotes from the article

"*A minimal cell is usually defined as a cell in which all genes are essential. This definition is incomplete, because the genetic requirements for survival, and therefore the minimal genome size, depend on the environment in which the cell is grown. The work described here has been conducted in medium that supplies virtually all the small molecules required for life. A minimal genome determined under such permissive conditions should reveal a core set of environment-independent functions that are necessary and sufficient for life. Under less permissive conditions, we expect that additional genes will be required.*"

"*Syn3.0 is a working approximation of a minimal cell. Our first* *synthetic cell, syn1.0, contained 901 mycoplasma genes plu s some watermarks and vector sequences. Of these, 428 have been removed in syn3.0, leaving 438 protein-coding genes and 35 RNA genes. More genes could probably be removed while retaining viability, but it seems likely that growth rate would be compromised*."

"*The largest group of genes retained in syn3.0 is involved in gene expression (195 genes, 41%). Approximately equal numbers of genes are involved in the cell membrane (84 genes, 18%) and in metabolism (81 genes, 17%). " replication of the genome and the preservation of genomic information through cell division (36 genes, 7%)"*

"Unexpectedly, there are 79 genes (17%) that we have been unable to assign to a functional category. Of these, 19 are in the essential category (e-genes), 36 are needed for rapid growth (i- or ie-genes), and 24 are nonessential or nearly so (n- or in-genes). We presume that most of these will fall into one of the four major categories described above (gene expression, membrane structure and function, cytosolic metabolism, and genome preservation)"

(If discovered in another way might have been regarded as junk DNA)

Compare the J Craig Venter Institute's research with the 2015 press lesease regarding the 2015 Chemistry Nobel Prize and to the other research articles mentioned in this post, and it becomes clear that we are still at the mid 1800's. The origin of life is still a mystery.

Another important observation is many researches propose other more stable code carriers to proceed RNA and DNA. These researchers however neglet to mention an very important fact. DNA must have contained the code that protects itself from decay (error recognizing and error repair) from its beginning. DNA is an excellent code carrier regarding all other requirements expected of a code carrier. (duplication, execution and effective control in the execution of the code). Its only drawback is its error prone code copying).

Why would a more stable code carrier evolved DNA with code protection enzymes present in the first DNA molecules (refer Press Release 2015 Chemistry Prize laureates) It introduce the possibility of foreknowledge. Foreknowledge that DNA would be more versitile but unfortunaly very unstable. Foreknowledge had to introduce code protection.

Was DNA preprogrammed by a pre-existing code? Nothing in our current knowledge contradict this view, it rather gives support to this view.

According to our current knowledge the "Only life begets life' theorem still appears valid .

Closing remarks : 1 A JCVI syn 3.0 type of minimal cell that also contains the genes (code) to fix nitrogen and to produce chlorophyl, will only need carbondioxide, water and sunlight to kick start life an produce its own homochiral nutrients and building blocks. No need to depend on an abiotic source. Cyanobacteria is one of the oldest (if not the oldest) known life form and is an excellent candidate

2. Only a living cell can decipher and execute the genetic code.

Thoughts to ponder on :

Only cellular life seems to be real life. Code carriers are not effective outside living cells. (exception very well controlled lab condtions)

Only continuous chemical reactions guided and fine tumned by the gnetic guide through ribozymes and enzymes can be regarded as life.
Another thought to ponder on is what was first, the replicaters or the code? Is it a egg-chicken situation? According to the our current knwledge isn't it more a situation of " witout the code neither the egg, nor the chicken would exist " ?