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MIRROR LIFE & THE POSSIBILITIES OF TOMORROW

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ABSTRACT

Isomers[1] are molecules with the same molecular formula but a different spatial arrangement of atoms. Now let's consider what happens if we use molecules of chirality[2] different than the one present in naturally occurring life forms to form a mirrored life form? This is the concept of mirror life,[3] a life form with altered molecular chirality. Even though this concept is theoretically possible and in nature we have observed presence of various enantiomers,[4] We have yet to find a naturally occurring mirror life form as the biology of life on earth is homochiral[5] i.e. Life specifically uses enantiomers of fixed chirality only.

KEYWORDS: This is the concept of mirror life,[3] a life form with altered molecular chirality.

INTRODUCTION

The unit of life is cell and what is cell made-up of ?It’s made of water, inorganic ions, and carbon-based organic molecules like proteins, lipids, and carbohydrates. On further research, We discovered something interesting and which is that all lifeforms on the earth have left-handed amino acids and right-handed sugars even though we have discovered molecules with both left-handed and right-handed molecular chirality in nature but when it comes to biological lifeforms we have noticed that only a specific handedness is being followed. This brings us to the question that is it possible for life to exist with altered handedness? This was the question that was the foundation of concept of mirror life, Lifeforms with right-handed amino acid and left-handed sugars.

CHIRALITY

Around 1840s while researching On Tartaric acid Sir Louis Pasteur discovered[6] that when synthesized chemically 50% of crystals of tartaric acid produced were Structurally different, They were chemically same but were non superimposable mirror image of each other. His studies on these crystals led to the discovery of molecular chirality. In his studies he also mentioned that tartrates produced biologically were of all same type rather than 50/50 mix when produced chemically, This indicated that nature is selective towards the handedness of compounds, This observations of his leads him to the question of what if we can produce a lifeform with alternate handedness ? What would it be like? How will it behave? Or how will interact with current lifeforms? All these questions were the foundation of concept of mirror life.

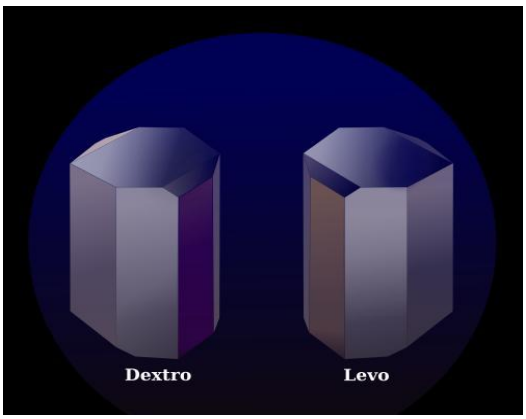

Image 1[7]

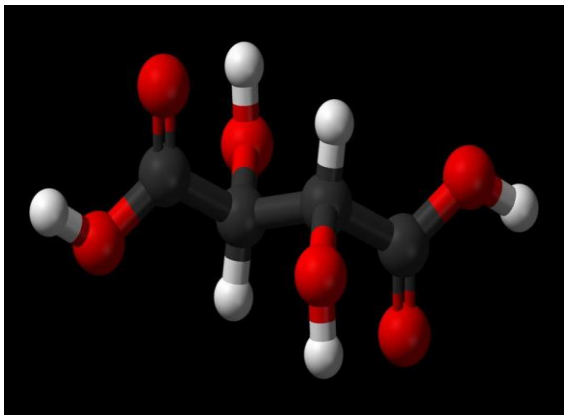

Image 2[8]

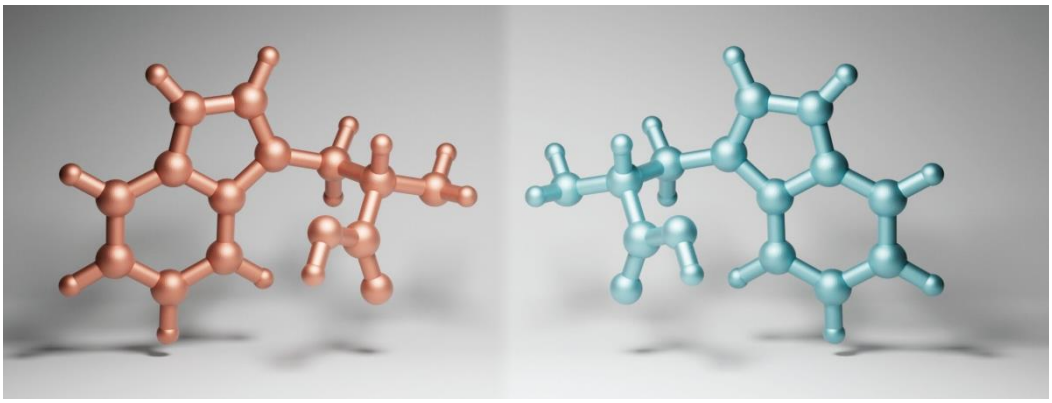

Image 3 [9]

MIRROR LIFE

It's a hypothetical life form made-up of mirrored compound like right-handed amino acid and left-handed sugars.[10] It's a century old concept, Though we are currently incapable of

producing a mirrored lifeform, Synthetic production of molecules with different charity is possible. Mirror biology is an emerging field that explores the creation and behaviour of mirror-image biological systems. It includes the study of mirror molecules—synthetic versions of natural biomolecules with opposite chirality—and the more speculative mirror organisms, which would be entirely new, self-replicating life forms built from these components.[11]

For the creation of a mirrored life form there are various technical and scientific challenges such as synthesis of complex molecules, assembling a fully functional cell, funding etc. There are also ethical concerns that whether we should allow the development of such life forms or not.

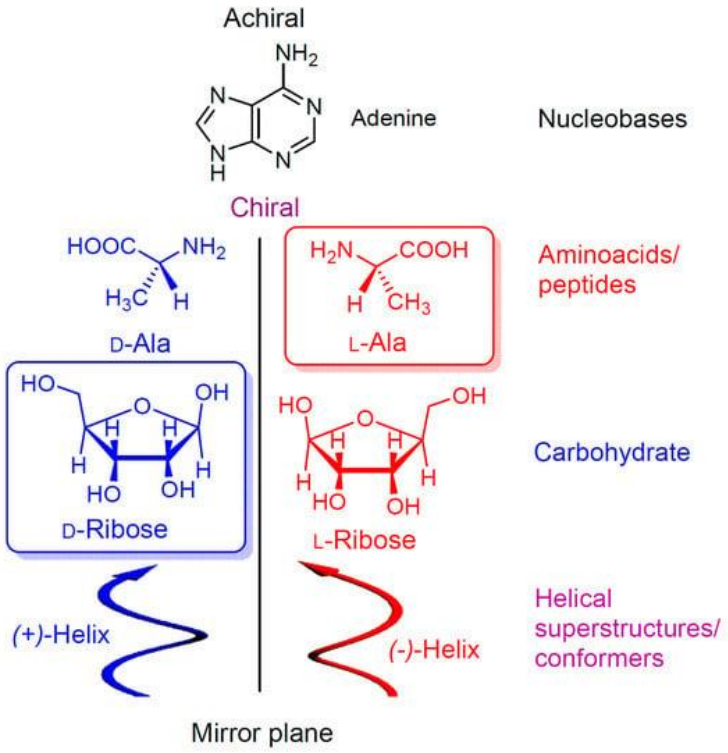

Image 4[12]

CHALLENGES

Synthesis of complex molecules: Production of heterochiral molecules is chemically possible but it can be a time consuming and costly process even in case of simpler molecules for example If on synthesizing a compound we get it's racemic mixture[13] i.e. The produced mixture consists of both the enantiomers in ratio of 1:1, we have to separate these enantiomers to be able to use the desired enantiomer, Then use them to form more complex molecules.

Mirror ribosomes:[14] Ribosomes[15] are biological 3D printers that are capable of production of proteins from amino acids and to make longer mirror proteins scientists need to reengineer biology's protein factory, the ribosomes and even though it's needed to mass-produce mirror proteins, it also requires the very same mirror proteins to be assemble it in first place, without mirror ribosome we cannot mass produce mirror proteins and without mirrored proteins we cannot make a mirror ribosome.

Mirror cell:[16] The most difficult challenge, though, will be putting everything together. Even if someone makes a mirrored genome and all the other parts required for protein synthesis,[17] there's no guarantee that they will "boot up" to create a viable organism. Making life from scratch is an uncharted territory.

MERITS

Research on mirror life could expand general knowledge about biology and potentially lead to better drug development while preventing various side effects. Mirror life is not technically feasible at this time but the knowledge we have acquired from studying about it has been very beneficial.

Immune invasion:[18] This so-called mirror life– living cells made from building blocks with an opposite chirality to those that make up natural life – could have very similar properties to natural living cells. They could live in the same environment, compete for resources and behave like you would expect of any living organism. They would be able to evade infection from other predators and their immune systems because their opponents wouldn't be able to recognize them.

Drug stability: As chirality of mirrored molecule is different then that of all earth lifeforms on earth they do not interact with these molecules meaning that these molecules can resist breakdown by the body's enzymes, leading to development of more effective and stable medications The creation of mirror molecules could have benefits, especially in the fields of research and medicine. Compounds such as Degarelix and Difelikefalin, essentially composed of mirror amino acids, are already available on the market.[19]

Novel therapies:[20] The knowledge we will acquire from researching on this topic will surely open doors to the development of new drugs, diagnostic tools, therapies, procedures etc. What exactly will we achieve is something only future can tell.

RISKS

Where there is light, there is shadow, If it has pros it also have cons just like two different faces of the same coin developing a mirror lifeform also have various risks.

Immune invasion: As mirror molecules does not interact with living beings due to difference in chirality this means our immune system would not be immune towards attack of a organism made-up of mirrored proteins.

Resistance to Existing Treatments: Most current antibiotics and medical treatments are chiral-specific. They are designed to target natural-chirality structures and would likely be ineffective against mirror pathogens.

Unpredictability: As it's a new field of science in which we are pioneering into there is too much that we don't know, Why exactly is Biology homochiral ? Would introducing mirrored life forms leads to formation of a second tree of life? How exactly will mirrored life form interact with regular life forms? These are some of many questions that still remains unanswered.

Food chain: Every Organism in an ecosystem is interconnected to each other, one organism feeds off another, life cycle of each Organism directly or indirectly affects life cycle of other one, it is nature's way of regulating life on earth but what if we introduce a life form with no predators, will it continue to multiply uncontrollably till it have enough food? We don't know. It might disturb our ecosystem completely.

CONCLUSION

Mirror life a concept theoretically possible but is yet to be achieved many scientists suggests that it might take decades of research to make this concept a reality and in doing so the knowledge gained will surely enhance our current understanding of nature and leads to development of various new technologies. Despite the risks associated with development of a mirrored life form we have seen successful use of mirrored molecules in the field of medicine because knowledge in this field if insufficient we cannot conclude how exactly technologies developed from studies on mirror life will affect our day-to-day life, Will it be harmful or beneficial? It's something only time can tell.

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