

Life: We know the ingredients but not the recipe. Nitesh Vinodbhai Pandey¹, Researcher, Indian Astrobiology Research Centre, Mumbai, India. Email id: niteshpandey@iarc.res.in

Abstract:

The two Saturnian moons namely Enceladus and Titan as well as the Jovian moon Europa are the top candidates for hosting a life of an independent origin within our Solar system. The recent discovery of molecular hydrogen within the plumes of Enceladus by the Cassini flyby mission has further increased our hopes in the Icy moons as a potential candidate for hosting life [1]. Europa and Enceladus both have all the prerequisites that are required for the origin of Earth-centric life. Both of these moons have liquid water in the form of salty oceans, strong energy source produced due to tidal heating and organics required for the building blocks of life. Titan, a moon of Saturn, is an oddball among all the prospective places within our solar system as far as habitability is concerned. Titan is seen as a place that might host a life but of a very different or rather exotic nature. The moon has lakes composed mainly of liquid hydrocarbon and its atmosphere is known to have Polycyclic aromatic hydrocarbons produced because of the photochemistry and bombardment of charged particles coming from various sources [2]. It has been always speculated that since Titan fulfils all the general requirements of life like Thermodynamic disequilibrium, presence on organic compounds and a non-aqueous solvent composed of liquid ethane and methane, it might still harbour a life though of a very different nature in terms of its biochemistry. The recent discovery of Vinyl cyanide in the clouds of Titan has made it more interesting from the perspective of finding an exotic form of life. The reason for this is the ability of vinyl cyanide to form cell membranes like structures in liquid methane and liquid ethane [2]. These structures can act like Phospholipid cell membrane as we see with the life forms on Earth. Titan has also been given the highest Planetary Habitability Index in our solar system by the ranking system created by Schulze-Makuch et al [3] I, however, have serious reservations about this outlook towards Titan. It is very much possible that one day we might find a life very different to what we know here on Earth. However, it would be too early to think of such kind of life. The reason being that we hardly understand the current model of Earth-centric life. The life even on Earth is much more than a combination of organic macromolecules, an energy source and water. What we know is that with time such combination leads to the formation of an autocatalytic self-replicating chemical system that can isolate itself from the surrounding environ-

ment and undergo Darwinian evolution. As far as understanding life is concerned I would say we have just started to scratch the surface of abiogenesis. The major insights are mainly coming from the studies concerning the emergence of complexity in a system far from equilibrium. The analysis of the oldest biological ecosystems near the alkaline hydrothermal vents has given us some glimpse of the primitive metabolic cycles that are independent of ecosystems that have used light as an energy source rather redox chemical gradients. These ecosystems that thrive near the alkaline hydrothermal vents are the most primitive form of life and therefore a proof that it is the life that utilizes redox gradients will precede a life surviving on photosynthesis. The Alkaline Hydrothermal vents very much like modern autotrophs drive the production of pre-biotic chemicals by reducing Carbon dioxide using the energy coming from the proton gradients [4].

Even though we know the major ingredients of life we certainly do not know its recipe and therefore not a single lab has been able to build a chemical system that resembles life so far from scratch. It is only after we understand a model of life dependent on the water we can tweak its major variables to check if there are other alternate chemical systems possible which can be called as life. In a situation where we hardly have a model of life, it makes no sense to even think of going to a place that may host some exotic form of life that we hardly understand. Titan is no doubt a very interesting place but given by how costly Astrobiology is as an endeavour, It would not be practical to visit Titan before we understanding the Earth-centric life completely.

References:

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