

Robert pascal's theory on icy moons | analysis



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In Robert Pascal's research article, "Physiochemical Requirements Inferred for Chemical Self-Organization Hardly Support an Emergence of Life in the Deep Oceans of Icy Moons", Pascal presents different hypotheses of the formation of life on icy moons compared to life on Earth. Liquid water, free energy, and organic matter are the three essential components to start the origin of life. In addition, the complexity of the environment and the structure of the entity itself are also essential to the formation of life. On these icy moons, Pascal states that there would have been an event which was highly unlikely, taking place to combine these components. These events are considered, because our knowledge of astrobiology is only limited within the parameters of Earth.

On icy moons, life will be significantly simpler than of life on Earth due to the insufficiency of the components used to start the origins of life. The first component is liquid water, water plays a major role in creating life on Earth and most of the living organisms on Earth grow in wet environments. The properties of water being a solvent and to be able to dissolve mostly everything allow organisms to evolve in different environments. The second component is organic matter which is present in minerals. Organic matter is combined together with water and energy in a long process to help the entity grow its structure. The third component is energy which allows an endergonic reaction to take place to create a chemical reaction with water and organic matter. Kinetic barriers are also formed by existing energy around the entity which depends on the temperature in the environment during the origin of life process allowing system to maintain its equilibrium state and further evolve.

In addition, the entity must be capable of reproducing itself leading to the evolution of the entity. The second law of thermodynamics is applied to demonstrate how the entity maintains its equilibrium state coupled with a form of stability, called dynamic kinetic stability (Robert Pascal, 2016) which enables the entity to reproduce itself towards an irreversible stage.

Considering all theories and conclusions researchers have come to, Pascal states that the final parameters which determine how the origin of life will be formed is the covalent bonds of the entity relative to the liquid water around it, the temperature of the environment where the entity resides, liquid water, and an energy source equivalent to light.

The origin of life of different extra-terrestrial systems depends on the complexity of the evolution of the entity and the complexity of its environment. The oceans on Jupiter and Saturn's icy moons have a significantly lower temperature environment compared to the Earth, with no light or alternative energy source that would reach the entity to start any kinetic irreversibility leading to a conclusion that an event that was highly unlikely would have taken place to start the origin of life process in the oceans of the icy moons. It is believed that on the icy moons, chemical gradients are contained between the crust and the ocean which meets the criteria of the origin of life on Earth.

Pascal uses the knowledge of astrobiology within the parameters of Earth to present three hypotheses about how life would form on these icy moons. The first hypothesis is called panspermia, which is the theory of the origin of life would have originated from microorganisms from outer space, which upon reaching a suitable environment, is able to initiate life. The second

hypothesis considered entities that have experienced conditions that would allow the entity to take in liquid water through the environment and solar energy by exchanges through the atmosphere. The second hypothesis was deemed incompatible as the time duration of the process would be too short for the process of chemiosmosis. The third hypothesis was the subduction process in the ocean which would have activated chemicals capable of feeding the chemical protometabolisms. This shows that including the present day knowledge of astrobiology and the origin of life process, the origin of life process in the oceans of icy moons must also include an event that would be highly unlikely of taking place as the formation of life on different extra-terrestrial systems depend on the complexity of its environment and the evolution of the entity itself.

In Pascal's "Physiochemical Requirements Inferred for Chemical Self-Organization Hardly Support an Emergence of Life in the Deep Oceans of Icy Moons", the information in the hypotheses about the formation of life on icy moons are limited, because our knowledge of astrobiology is only limited within the parameters of Earth.

Reference List

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