IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

ASTROBIOLOGY AND THE SEARCH FOR PANSPERMIA.

Ashutosh Khaswal(*1,a,i*), **Samarth Saxena**(*2,b,i*), **Neha Chaturvedi**(*1,a,i*), **Karan Khaswal**(*1,c,ii*).

(1) Student, Dr. A.P.J. Abdul Kalam Technical University, Uttar Pradesh, India.

(2) Student, Chaudhary Charan Singh University, Uttar Pradesh, India.

(a) B.Tech (Biotechnology), IMS Engineering College, Ghaziabad, Uttar Pradesh, India.

(b) B.A (Economics),CCSU, Meerut, Uttar Pradesh, India.

(c) B.Tech (Mechanical Engineering), Krishna Engineering College, Ghaziabad, Uttar Pradesh, India.

(i) International Diploma in Astrobiology, Indian Astrobiology Research Foundation, India.

(ii) International Certification in Space Sciences, IARF, India.

Abstract: From past several years, Scientists, Astrobiologists as well as Researchers are engaged to find 'How life came into existence on Earth?'. In 1974, Great Scientists Fred Hoyle and Chandra Wickramasinghe proposed a hypothesis related to Panspermia. This research paper Strengthen the belief in Panspermia. our team has a vision to keep non-Pathogenic Extremophiles (which are capable to survive in the extreme conditions of Space) alive throughout the long journey to the Moon of Jupiter 'Ganymede' or 'Europa' from the planet Earth with the help of a Hypothetical Model 'AeroHeart' designed by our team. This model is well capable to keep non-Pathogenic extremophiles alive throughout the journey in outer space. "AeroHeart" is designed as a cylindrical tank containing four different compartments separated from each other and each compartment having a plant which will be the food for Extremophiles. In order to keep plant alive, We use the system of Aeroponics. Also, Model contains 'Aero-Hydraulic ejector' which transfer excess amount of Extremophiles into compact ejector bottles having Nano-sensor for tracking which can be ejected towards other Celestial Bodies (Asteroids, Meteors, Comets) coming across the path of spacecraft to test 'directed Panspermia' over there.

Keywords – Extremophiles, Panspermia, Ganymede, Tardigrades, Europa, Aeroponics, AeroHeart, Extra-terrestrial.

I. INTRODUCTION

A very well known theory 'Panspermia' talks about the question, "What is the origin of life and how we get life on our planet Earth. Renowned Scientists ponder, Life originated from extremely high organic compound, Extraterrestrial pollens present everywhere in the Universe, in the form of space dust. Keeping that in mind, our team has a vision to send out non-Pathogenic extremophiles from our planet Earth to other extraterrestrial bodies and check whether they survive or not. But the main challenge for our team is how to keep non-Pathogenic extremophiles alive throughout the long journey in outer space. To overcome this challenge, our team designed a hypothetical model which is capable to keep non-Pathogenic extremophiles alive throughout the long journey in outer space For this project, we are eager to examine Panspermia on the moon of Jupiter "Ganymede" or "Europa". Why Extremophiles? Because these organisms can survive in poly extreme climatic conditions. The Basic structure of "AeroHeart" is based upon the structure of 'human heart', likely it also contains four interconnected Chambers. Each Chamber Contain a plant *Aloevera* and for the essentials of plant, the system of Aeroponics used. AeroHeart is a unique idea to examine Panspermia.

II. METHODOLOGY

Our main objective is to keep Extremophiles alive throughout the journey to the moon of Jupiter (i.e. 6 year and 6 months approximately) by using our system AeroHeart. AeroHeart is designed as an automatic natural system to preserve micro-organism (Extremophiles) in space for long duration i.e approximately 10 years by supplying them proper food and nutrients by the Aeroponics cause that require less water, less energy and less maintenance . In this system, the plant roots are exposed to sufficient nutrients which they can absorb easily. For this project, our targeted destination is the moon of Jupiter "Ganymede" or "Europa". Another objective is to observe life of Extremophiles under environmental conditions of Celestial bodies (Comets, Asteroids etc.) by deliberate transportation of micro-organisms in Space and experimentally fortifying the theory of Panspermia by using 'directed Panspermia' and 'nanotechnology'. The scope of the thesis is to check whether life harbor's on Ganymede environment or not, by sending both eukaryotic and prokaryotic Extremophiles like Tardigrades and *Dianococcus radioduran* to the moon of Jupiter Ganymede or Europa. Secondly, to send Extremophiles on those Celestial bodies that will come across the path. Extremophiles, in abundant amount, will be packed in advance artificially designed bottles having nanosensors and 'location detecting system' that help us to reveal the evolution of life (*if exist in future*) on the Celestial body.

III. HYPOTHESIS

According to the theory of Panspermia, life originated on the planet Earth from microorganisms or chemical precursor of life present everywhere in the universe. Our model works on the hypothesis that life can evolve anywhere in the universe through spores and other minute organisms in a dormant state on reaching a suitable environment. Model AeroHeart is designed to make Extremophiles(act as pollen dust) alive throughout the space journey and transfer them towards celestial bodies by directed Panspermia that would leads to examine the Theory of Panspermia.

If extremophiles survive in the environment of celestial bodies or our projected moon of Jupiter 'Ganymede', it will straightly conclude that the life may had originated on Earth through Panspermia.

IV. LITERATURE AND REVIEW

4.1 Theory and its proof:

Panspermia hypothesis was given by great Scientists Chandra Wickramasinghe and Fred Hoyle in 1974 .This hypothesis says that little dust particle in interstellar space was largely organic compound. According to theory, life on the Earth arrived from space as the seeds of life was already present in the universe. They states that these seeds or microbes transported here by meteorites, comets or by spacecraft.

4.2 Identification of organism:

Micro-organisms which can easily survive in extreme conditions of acidity, pressure, salinity, temperature, toxin concentration or salinity are extremophiles. For an organism to be classified as an Extremophiles, it must complete its entire life cycle in extreme conditions. These Extremophiles have been found in various extreme environments on Earth; from hydrothermal vents to frozen lakes. For our model, we consider both Eukaryotic and Prokaryotic extremophiles.

4.3 Selection of two microorganism tardigrades and *Deinococcus radioduran*:

Tardigrades- Tardigrades also known as water bears are microscopic animals with four pairs of legs and a complicated feeding (buccal) apparatus. They come in the variety of colors and can be transparent as well. Their size can range from (0.05-1.2) mm long. They are capable of surviving in extreme condition(15). They have ability to withstand high pressure, vacuum and temperatures as high as over 424 k to as low as 1 k (almost the absolute zero!) .They may also enter into Cryptobiosis which is a truly deathlike state in which metabolism lowers to 0.01%. *Deinococcus radioduran*- Calling *Deinococcus radioduran* an Extremophiles is not fair, rather *Deinococcus radioduran* –A polyextremophiles because it can tolerate many extreme conditions.. Special property of *D. radioduran* is to capable of fixing a shattered genome in just a few hours. High doses of radiation shatter genomes of any organisms but *D.radiodurans* can repair it like new in just few hours. The maximum doubling time of Tardigrades is about 3 hours. *Deinococcus radioduran* can resist 1.5 million rads of gamma radiation, about 3,000 times the amount that would kill a human. In addition to this it can survive high doses of UV rays.

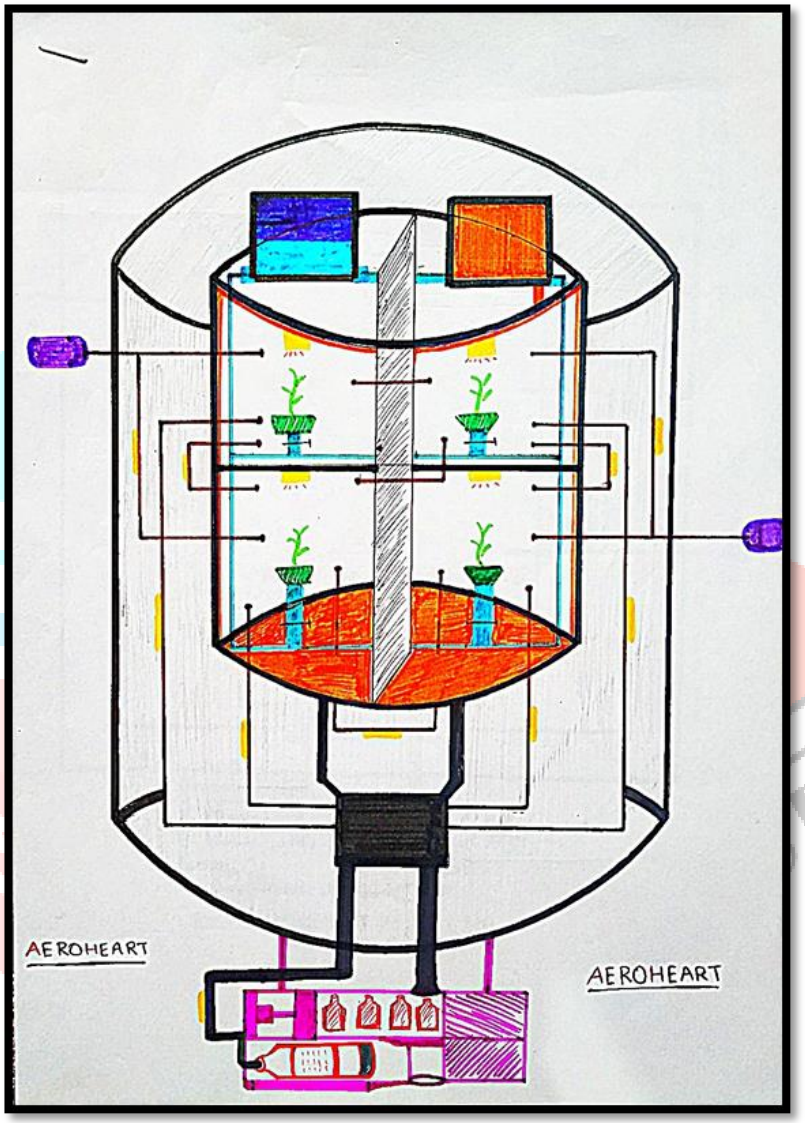
4.4 Experimental setup for survival and culturing of tardigrades and *Deinococcus radioduran*:

Aeroponics- There are several methods to obtain plants with maximum growth and productivity. But Aeroponics is a method to grow plant without soil. In this method plant growth take place in air or we can say it is indoor planting method having many advantages. In this process, water and nutrient solutions are given for its growth. Aeroponics are similar to hydroponics and Aquaponics at some extent but Aeroponics does not require growing medium like hydroponics and Aquaponics. Aeroponic process totally perform in air hence we need to take care of environment in order to grow plants more quickly and healthy. Plant growth starts with cutting of seeds. Then

transferred to a chamber in mid-air where growth and other processes take place. Nutrition to the plants are provided by spraying nutrient solution on plant roots.

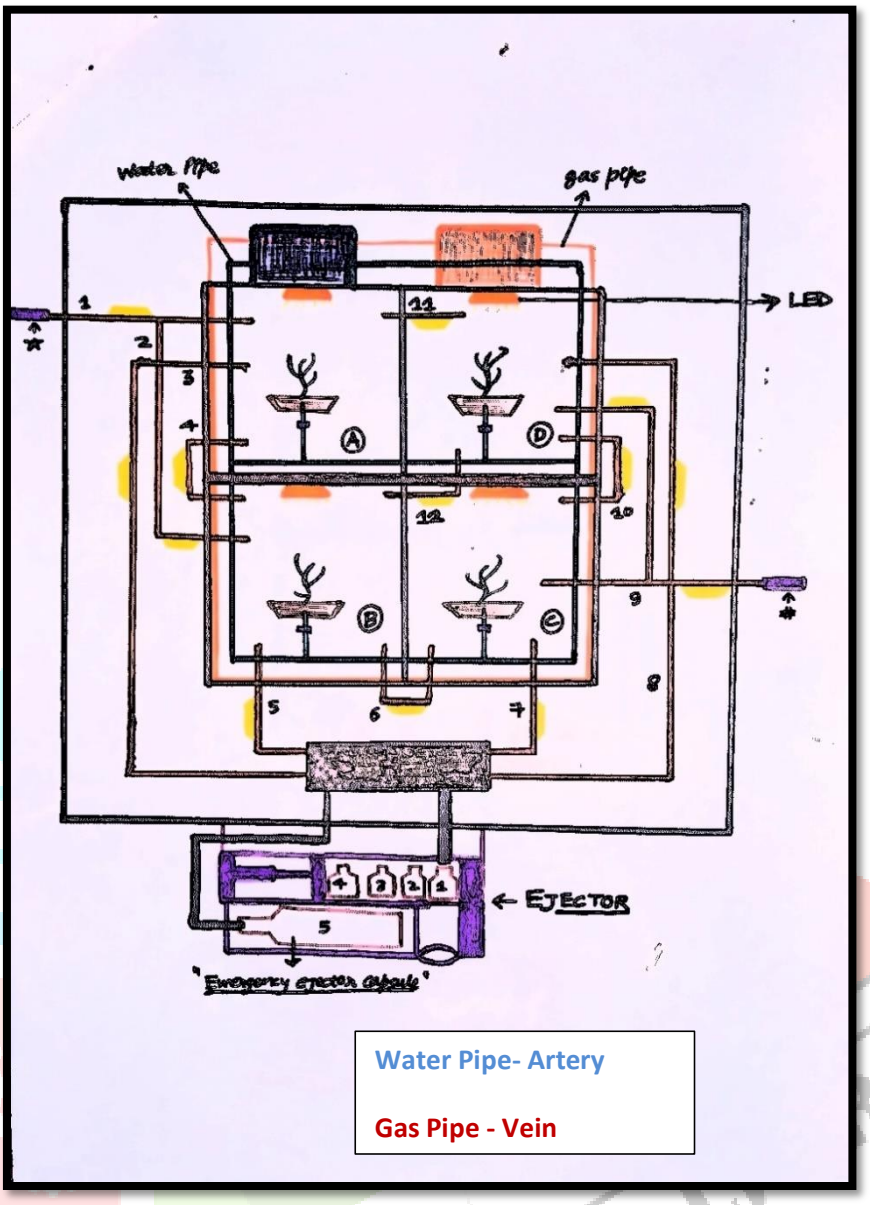
V. MODEL

AeroHeart 1.1 – Model (figure 1)



A figure represents a cylindrical shaped model named as AeroHeart having four isolated compartments interconnected with pipes(Brown) and two chamber(blue and orange)s that contain essentials for the survival of Plants that reaches to each plant with the help of pipes(orange, blue) as a System of Aeroponics. Also, Aerohydraulic ejector(violet) is represented in the figure that contains smart capsules with location detecting sensors.

AeroHeart 1.2 – Mechanism (figure 2)



A figure represents labeled Diagram of our model AeroHeart. Numbering to all the pipes is classified in Working of the model. Water Pipe(blue) is considered as an Artery to the model and Gas pipe(orange) is considered as a vein to the model. Capsule (*) and Capsule (#)(blue) is considered as an extremophiles capsules contain both prokaryotic and eukaryotic micro-organisms in dormant stage. Also Model have an Aerohydrolic ejector (violet) contains emergency ejector capsule explained in working part of the paper.

VI. BASE STUDY METHODS AND WORKING

Firstly, Aeroponics will be used to supply water and nutrients to the plants. We select plant Aloevera because it require less amount of water, have longer lifespan and highly regenerative in nature. Secondly, Aeroheart have two cylindrical tanks one containing oxygen gas and hydrogen gas, and another containing carbon dioxide gas. Moleculer weight of hydrogen is less than water hence when pressure is increased inside the tank one hydrogen will react with oxygen and results in formation of water.

It also contains an Ejector which is used to eject 95% of microorganism from the Chamber when the amount of Extremophiles is in abundance. It ejects capsules full of Extremophiles which contains nano-sensors and location detecting device (to co-ordinate further) towards any asteroids, comets, meteors, etc which come across the pathway to the Ganymede to examine Panspermia over there. For this project, our team considering Ganymede as our probe destiny, which is 628.3 million km away from Earth and take approximately 6 year 6 months to reach there. So in the beginning, Capsule containing microorganism /Extremophiles will be activated when the spacecraft will enter into the outer space. Extremophiles from the capsule (*) will be transferred to "Chamber A". Here in Chamber A, Extremophiles will consume the plant as a food and make copy of itself. After 2 year, the 5% of Extremophiles (of Chamber A) will transfer into Chamber B and start consuming Chamber B's plant, remaining 95% of Extremophiles in Chamber A will be transferred into the ejector through pipe no. 3 (in fig) thereafter, they will be transferred into ejector capsule 1 and they will eject towards any celestial body. Now, when Extremophiles consumed Chamber B's plant (approximately in the fourth year of journey) again the 5% of Extremophiles will be transferred into Chamber C and 95% of Extremophiles will eject through ejector capsule 2. After 6 year and 5 month of journey, 5% of the Extremophiles will be transferred into capsule(#) (which is final capsule to test) and 95% of the remaining will be transferred into the ejector capsule 3 and ejected. Note- the Chamber D is for emergency purpose only. Ejector capsule: each ejector capsule will contain a label on which there will be an information for extraterrestrial life (if exist). The bottom of capsule contain system of nanosensor to locate and observe the capsule.

"In the end, after the landing of spacecraft on Ganymede, the Extremophiles in capsule (#) will use to test the Panspermia and other possible test about life on Ganymede".

For Safety protocol, As we can see here, the journey to the Ganymede will take 3 Chambers of AeroHeart, it means AeroHeart won't get failed in its mission if any one of the Chamber failed to perform its function in midway. AeroHeart also contains Emergency routes for emergency purpose in the system i.e.

1. If Chamber A won't work- than the Extremophiles will directly transfer to Chamber B via pipe 2, from the capsule(*).
   Capsule(*) -> Chamber B –> Chamber C >– Chamber D –> Capsule(#).
2. If Chamber B won't work- then the Extremophiles will transfer from Chamber A to Chamber D via pipe 11.
   Capsule(*) -> Chamber A –> Chamber D –> Chamber C –> Capsule(#).
3. If Chamber C won't work - then the Extremophiles will transfer from Chamber B to Chamber D via pipe 12.
   Capsule(*) -> Chamber A –> Chamber B –> Chamber D –> Capsule(#).
4. If Chamber D won't work- then the cycle would be as it is.
   Capsule(*) -> Chamber A –> Chamber B –> Chamber C –>Capsule(#).

Each Chamber Contains individual pipe and individual ejector capsules, so if any of the Chamber get failed, there would be no effect / damage to the system. If anyhow the ejector capsule didn't eject, than there is a backup ejector

tank available for all Extremophiles. All the excessive Extremophiles will transfer into emergency ejector tank (5) and it can be ejected as per requirement. In the system all Essentials for life are inbuilt i.e. Reservoir /H-Tank/pressure pump When the plant of a Chamber will get consumed by the Extremophiles the water supply of that Chamber will shut down.

VII. DISCUSSION

7.1 Moons of planet Jupiter:

'Ganymede' - A moon with 5262 km of Diameter rotating around Jupiter with velocity of 6229 km/h. It takes 7.16 days to complete a round around Jupiter. Its size is nearly equal to Mars with very low density of 1.936 g/cm3. It is very cold planet with temperature range of 80K-102K. It contains a thin oxygen atmosphere including O, O2, O3, H2 and a magnetosphere. From past studies, it had been concluded that Ganymede moon contains Salty ocean below its surface (more salty than that of Earth's ocean). It has a gravitational force of 1.428 m/s2 and escape velocity of 2.741 km/s. pressure on the surface of moon is very low, ranges between 0.2-1.2 uPa. The surface is made up of Silicate rocks and water ice (iron:silicon=1.05-1.25). Ganymede's surface have two types of terrain i.e. 60% is lighter with grooves and remaining 40% is dark with numerous craters creating intricate patterns giving a distinctive appearance to the moon. Also, It had been found that this moon doesn't contain valconism and the Radiation in environment is about 50-80 mSv. A distance from Earth is 628.3 million km, Till now, Maximum time to reach there is 6 years 9 months (Cassini Spacecraft) and the minimum is 3 years 2 months (Yoyager 1). A moon with tidal locking (no roation on its axis, no seasons), underground water, Atmosphere, Gravitational force, Magnetosphere is our targeted destiny to examine Panspermia. On the other hand, Another moon of Jupiter, 'Europa' also show Tidal locking and completes one orbit of Jupiter every 3.5 Earth days. In comparison of size Ganymede is 1.7x larger than Europa. Europa shows Abundant liquid water, energy and the right chemical elements which increases the chance of life on Europa.

7.2 Systems

Microorganism that can survive at high temperature, or in extreme conditions like in space are extremophiles. Tardigrades and *Deinococcus radioduran* extremophiles fulfill needs required in our model AeroHeart. Survival and culture of these small extremophiles in space will accomplish by green plant Aloevera . Aloevera is a green herbal ayurvedic plant which require less amount of water and can survive for longer duration in dry conditions. Along with this, aloevera have many other properties. But major thing that complete our model is 'Aeroponic method of culturing' in which plant can grow without soil having roots in air. This method only requires spray of organic nutrition and water on the roots present in air. Although it will take time but it is less complex system to prove panspermia. Aero-heart contains three essential chamber and one supplementary that will help during emergency. Our system will overview moon of Jupiter Ganymede or Europa along with other comets, asteroids and meteorites that will come across the path. No such theory or experiment have been yet performed that can proof panspermia as true of false. Aeroheart will be effective way towards the mysterious question "*how life originated on Earth*"? And is the theory of panspermia true?

VIII. CONCLUSION

As stated in our Hypothesis, We believe that life can evolve anywhere in the universe through spores and other minute organisms in a dormant state on reaching a suitable environment. There can be no doubt that AeroHeart model is worth capable to examine the theory of Panspermia by researching over non-pathogenic extremophiles in vacuum space with extremeties. If we successfully transfer non-pathogenic extremophiles on Jupiter's moon "Europa" or "Ganymede" and other celestial bodies, we could surely able to examine the life status of extremophiles. Also, if these extremophiles harbor's life over there, it would directly conclude in favor of 'Panspermia Theory' and also strengthen the myth that life has originated on Earth through the theory of Panspermia.

IX. LIMITATIONS.

The major challenge is the maintenance of suitable environment like proper Oxygen, Carbon dioxide and other essential nutrient supply, enough Water supply throughout the journey with an artificial gravity chamber. Then another challenge is that the Oxygen is exhaled by Aloevera which increases the pressure inside Chambers. That's why we have to make a system which can maintain the pressure in each Chamber for a plant by removing excessive oxygen. Also, we should use that oxygen in the formation of water by reacting it with hydrogen gas. Whole system should contain shock absorbers. The reproduction of Extremophiles is to high that they can double up at high rate and we have to eject them from AeroHeart to prevent any damage from them. In last, A suitable temperature is needed inside the Chamber throughout the journey.

X. ACKNOWLEDGEMENT

We would like to thank our Professor, Dr. Narendra Kumar from Department of Biotechnology, IMS Engineering College, Ghaziabad, for guiding us in writing this paper.

XI. REFERENCES

[1] Blumberg, BS (2003), The NASA astrobiology institute: early history and organization.

[2] Capova, KA, Persson, E, Milligan, T and Dunér, D (eds), Astrobiology and Society in Europe Today.

[3] Cockell, C, Landfester, U, Remuss, N-L, Schrogl, K-U and Worms, Humans in Outer Space.

[4] Crick FHC, Orgel LE (1973), Directed panspermia. Icarus 19: 341-346.

[5] Des Marais, DJ, Nuth, JA, Allamandola, LJ, Boss, AP, Farmer, JD, Hoehler, The NASA astrobiology roadmap. Astrobiology 8, 715–730

[6] Dr.Marco de Marchi, Verbiana-Pallanza., Ramazzotti E, Maucci W, (1983), The Phylum Tardigrada (translated by Beasley CW), Memories of the Italian Institute of Hydrobiology

[7] Horikawa DD, Kunieda T, Abe W, Watanabe M, Nakahara Y, etal.(2008), Establishment of a rearing system of the extremotolerant tardigrade Ramazzottius varieornatus: a new model animal for astrobiology. Astrobiology 8: 549-556.

[8] Hoyle F, Wickramasinghe NC, (1981) Comets and the Origin of Life. World Scientific Publishing Co Pvt Ltd, Singapore.

[9] Hoyle F, Wickramasinghe NC, (1985) Living Comets. (1stedn), Cardiff: Univ. College, Cardiff Press, UK.

[10] Hoyle F, Wickramasinghe NC, Evolution from space. JM Dent, London.(1980)

[11] Hoyle, F. and Wickramasinghe, Article in Diseases from Space, London.

[12] Hoyle, F. and Wickramasinghe, Proofs that Life is Cosmic.

[13] J Exp Biol 207:1607-1613, expression in Milnesium tardigradum (Tardigrada) during active and cryptobiotic stages.

[14] Janaki Wickramasinghe Chandra Wickramasinghe and William Napier, Comets and the Origin of Life.

[15] Jönsson KI, Rabbow E, Schill RO, Harms-Ringdahl M, Rettberg P, Tardigrades survive exposure to space in low Earth orbit. Curr Biol 18: R729-729R731 (2008)

[16] Jørgensen A, Kristensen RM (2004), Molecular phylogeny of Tardigrada--investigation of the monophyly of Heterotardigrada. Mol Phylogenet Evol 32: 666-670.

[17] Kinchin IM ,The Biology of Tardigrades. Portland Press, London.(1994)

[18] Manohar Lal OjhaAshok Kumar SumanV P SainiSharad Surnar, Effect of Physico–chemical and Biological Parameters on Growth of Indian Major Carps in Micro Watershed of Southern Rajasthan.

[19] Mojzsis SJ, Arrhenius G, McKeegan KD, Harrison TM, Nutman AP, et al.(1996), Evidence for life on Earth before 3,800 million years ago. Nature 384: 55-59.

[20] Nalin Chandra Wickramasinghe, Carl H Gibson, The Imperatives of Cosmic Biology

[21] Paul S. Wesson, (April 2011), Necropanspermia Article in Observatory-Didcot- 131(1221):63-66.

[22] Rhawn Gabriel Joseph Rudolph E. Schild, Biological Cosmology and the Origins of Life in the Universe.

[23] Schill RO, Steinbrück GH, Köhler HR (2004) Stress gene (hsp70) sequences and quantitative

[24] Surnar Sharma OPV P Saini, Nutrient harvesting through aquaponics-growth of Labeo rohita and production of plant.

[25] Watanabe M, Kikawada T, Fujita A, Adati T, Okuda T (2004), Physiological traits of invertebrates entering cryptobiosis in a postembryonic stage. Eur. J. Entomol. 101: 439-444.

[26] Wickramasinghe NC, Wainwright M, Smith WE, Tokoro G, Al Mufti S, etal. (2015)Rosetta Biology. Astrobiology Outreach 3:126.