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Posted Date: 19 June 2023

doi: 10.20944/preprints202306.1302.v1

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To Create Plant-Like Astronauts Who Can Adapt to Eternal Interstellar Expeditions

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Abstract: Based on the eventual destruction of the solar system and the critical need for human continuation, this article suggests sending synthetic biology- and AI-created plant-like astronauts to the closest habitable exoplanet, Teegarden's Star b. Here we show that these astronauts will have green skin, blue blood, and the ability to perform photosynthesis. They could withstand cosmic radiation and extremely low temperatures in space while generating energy through photosynthesis. This groundbreaking interdisciplinary approach may provide a solution to the survival challenges faced by humans on their eternal interstellar journey. As long as plant-like astronauts possess human consciousness, it does not matter whether they are even a hybrid of carbon-based and silicon-based life. They will be a continuation of humanity on exoplanets. Human faces two options for survival. The first is the Mars migration program led by Elon Reeve Musk, which remains within the solar system and may not protect against the Sun's future scorching all life on the solar system during its red giant phase. The second option involves a more daring approach: the frantic escape of plant-like astronauts from the solar system. Should we consider both options simultaneously, much like how humans use their two legs to walk?

Keywords: plant-like astronauts; artificial intelligence; synthetic biology; green skin; blue blood; human consciousness

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Many scientists who study the fate of the Earth say that the planet will eventually burn up (**Figure 1**). According to current stellar theory, the Sun would have expanded into a red giant long before the helium flash[1,2], scorching all life on Earth.

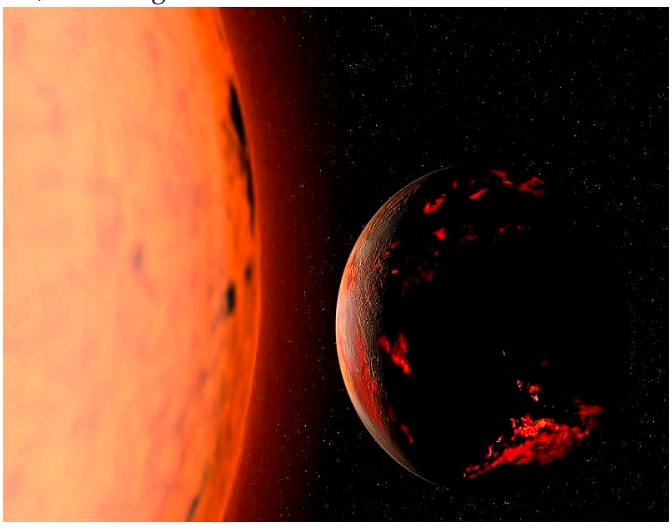

Figure 1. Artist's impression of the Earth scorched by our Sun as it enters its Red Giant Branch phase (Credit: Wikimedia Commons/Fsgregs).

For any species, survival and reproduction are the most important factors. Therefore, the most urgent scientific priority for humans should be to find a way out before our Earth ruin. Some scientist has already researched the issue of migrating extraterrestrial civilizations and interstellar colonization[3].

 doi:10.20944/preprints202306.1302.v1

Considering that humans cannot travel to the nearest exoplanet within a lifetime, the author proposes the transformation of humans by relying on AI and synthetic biology to create batches of plant-like astronauts who can adapt to eternal interstellar expeditions.

METHODS

My research methods for this study involve boldly making assumptions and carefully finding proof. As Albert Einstein once said, "We only observe what confirms our theories, which further hardens our beliefs and axioms"[4].

Everything I have done in this study may just be a result of my intuitive thought experiments, much like the ones famously conducted by Albert Einstein. Einstein is renowned for using imaginative scenarios to explore the laws of physics. For example, his famous elevator thought experiment was used to explain the principle of relativity.

RESULTS

3.1. An assumption proposed

Considering that humans cannot travel to the nearest exoplanet within a lifetime, the author proposes the transformation of humans by relying on synthetic biology and AI[5-8] to create one batch after another plant-like astronauts who can adapt to eternal interstellar expeditions. The proposed idea suggests transforming human astronauts into plant-like astronauts with green skin and blue blood, capable of undergoing photosynthesis to produce oxygen and carbohydrates using the abundant light energy from Stars during interstellar expeditions. They are not afraid of cosmic-ray radiation and extremely low interstellar temperatures. This approach may help solve the survival problems that human race will always face in its eternal interstellar expedition.

3.2. Finding proof

3.2.1. Human beings cannot travel to the nearest exoplanet to Earth within their lifetime

The planet Teegarden's Star b is the first confirmed potentially habitable exoplanet. It is located **12.5** light-years(**L.Y.**) from us. This implies that its atmospheric composition may permit the formation of stable liquid water on its surface[9].

Without taking into account factors such as gravitation fluctuations caused by the Sun and its planets on the spiral trajectory of human spacecraft leaving the solar system, as well as the power configuration of the spacecraft itself, we can only make rough estimates as follows:

We already know that the fastest speed of human aircraft is about 58,356 kilometers per hour[10], then:

How many kilometers would it take from Earth to Teegarden's Star b?

9,460,800,000,000 km/L.Y.[11] * 12.5 L.Y. = 118,260,000,000,000 km

How long does it take to fly from Earth to Teegarden's Star b?

118,260,000,000,000 km / 58,356 km/hr = 2,026,526,835 hours

= 231,339 years (rounded to the nearest year).

It would take **about 231 thousand years** to travel to the closest habitable exoplanet Teegarden's Star b from Earth.

The distance is too far for both humans and/or aliens to make the journey. This is why physicist Enrico Fermi sighed in 1950, wondering why we haven't seen any signs of extraterrestrial life[12].

Therefore, to avoid extinction during an eternal interstellar expedition, humans must transform.

Stephen Hawking also believed that humans must increase their complexity[13], although he had not studied it in detail.

3.2.2. Plants are better adapted to the environment than animals

- Mosses and lichens have strong anti-radiation abilities

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That is useful for interstellar expeditions. Research conducted on the Russian space station *Mir* has shown that the dangers of radiation from cosmic rays are real and can cause excessive oxidation of cells, leading to cancer[14].

● Plants are capable of producing oxygen and carbohydrates via photosynthesis

Plant leaves are like solar energy collectors crammed full of photosynthetic cells. These cells combine water and carbon dioxide molecules to create sugars and oxygen. If humans were able to photosynthesize, we would not need to carry as many oxygen tanks or food supplies during extraterrestrial exploration or interstellar travel.

3.2.3. The distinction between animals and plants is not clear

● Plants with animal characteristics, such as insectivorous plant

For example, *Nepenthe mirabilis* and *Drosera rokaiensis* (**Figure 2**). Their leaves can secrete mucus to catch and digest the worms.

Figure 2. Plants with animal characteristics (Left) *Nepenthe mirabilis* (Royalty-Free) (Right) *Drosera rokaiensis* (Encyclopedia).

● Animals that use cutaneous respiration can have plant-like characteristics[15-19] . For example, *earthworms* and *amphibians* (**Figure 3**).

Figure 3. Animals that use cutaneous respiration (Left) Earthworm (Wikipedia) (Right) A*mphibian* (Encyclopedia).

The skin of the human body has a potential respiratory function, but only during the embryonic stage. During this stage, the skin contains tiny pores, called stomata, which allow for gas exchange between the developing fetus and the amniotic fluid. However, once a baby is born, these stomata disappear, and the skin no longer has a respiratory function[20].

Can we reverse engineer or recreate skin breathing, taking us back to our embryonic stage?

3.2.4. Green skin

Plants can perform photosynthesis through the use of chlorophyll, which is produced by plants and certain bacteria. Even if humans had green skin, they would not be able to perform photosynthesis as it requires chlorophyll, which humans do not possess. However, humans have something similar to chlorophyll, which is hemoglobin.

Chlorophyll and hemoglobin (heme) are not contradictory, and under certain constraints, they can even lead to the synthesis of both [21].

There are precedents for photosynthesis in animals. In 1986, American scientists discovered a photosynthetic animal, a blue-green protozoan (blue trumpet worm). The blue trumpet worm can photosynthesize through the pigment in its body, converting light energy into adenosine triphosphate, which is the chemical form of cell energy[22] . Some animals, such as certain types of sea slugs and a few other organisms, have evolved to incorporate chloroplasts temporarily. Scientists have discovered two species of sea slugs that can regenerate their entire body, including major organs such as the heart and intestines, from a decapitated head. Theorizing that because these slugs incorporate chloroplasts from algae cells into their tissue for photosynthesis, this source of energy may support regeneration[23].

Some plant tissues implanted into animal bodies do not cause xenogeneic rejection:

● The tradition of using bamboo to set bones existed in ancient China. A fresh piece of bamboo is inserted into the broken bone, and its capillary vessels, which are very rich, gradually fuse with the bone tissue. After the broken bone has healed, there is no need to perform surgery again to remove the bamboo[24].

● In February 1987, Chlorohydra were collected in Song County, Henan Province, China. The Hydra was light green and had green Chlorella living in their inner cavity layer, which can undergo photosynthesis together[25].

3.2.5. Blue blood

The basis of blue blood is to make the blood of arthropods and mollusks appear blue. Hemocyanin is a copper-containing protein found in the blood of some invertebrates, such as octopuses and horseshoe crabs. It is responsible for transporting oxygen throughout the bloodstream and it gives the blood a blue-greenish tint due to its copper content[26]. The blue-green coloration of the blood plasma in some marine fishes, which is attributed to a protein-bound tetrapyrrole (biliverdin), is an anomaly in vertebrates [27-29].

In the same scenario, hemocyanin is superior to hemoglobin:

● It has a relatively high molecular weight and a stronger ability to bind and release oxygen molecules[30,31].

● Even at low temperatures, hemocyanin does not lose its oxygen-carrying capacity [30,31]. Therefore, the plant-like astronauts we seek should not fear the coldness of space.

It is not possible to naturally occur hemocyanin in human blood as it is only found in certain species of animals. Is it possible to find a way to artificially produce hemocyanin in the human body, which may increase the transportation of oxygen in the blood?

3.2.6. Synthetic Biology and AI

Waclaw Szybalski had yet a different meaning in mind when he coined the term “synthetic biology” in 1974[32]. Szybalski noted that recombinant deoxyribonucleic acid (DNA) technology would soon allow the construction of new cells with rearranged genetic material. He realized that this deliberate synthesis of new forms of life provided a way to test hypotheses about how the rearranged material contributed to the function of natural cells[33].

Today, the chemist’s vision for synthetic biology goes further. The hope is that molecular design supported by Structure Theory will yield unnatural molecular species able to mimic not just the binding and catalysis of specific biomolecules, but also the highest kinds of biological behavior, including macroscopic self-assembly, replication, adaptation, and evolution. Any theory that enables such design will have demonstrated an ability to account for these features of “life”, especially if

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chemists can make a synthetic version of life without exactly reproducing the chemistry of a natural terrain organism[33].

Recently *ACS Synthetic Biology* publishes a special issue on AI for Synthetic Biology[34]. "Synthetic biology has been successfully used to design biological systems with new and improved functions. However, due to the complexity of biological systems, performing synthetic biology in a quantitative and predictive manner still remains a challenge. In recent years, artificial intelligence (AI) and machine learning (ML) that allow computers to learn from experience has emerged as a potentially powerful tool to address this challenge." Corl wrote.

Elon Musk said in 2022[35] that using DNA sequences could turn humans into butterflies, and you can pretty much do anything with synthetic RNA.

Therefore, the theme proposed in this article "To create plant-like astronauts who can adapt to eternal interstellar expeditions" will be an ideal place for AI and synthetic biology to showcase their skills.

4. DISCUSSION

4.1. This study is interdisciplinary

I, the author, am an environmental scientist with a geological background who proposed this interdisciplinary study. I have already completed several similar studies, such as "Hydrogen Ice within Lunar Polar Craters" [36], 'Flying Fox: the animal origin of SARS-CoV' [37], 'On the native origin of the American Indians' [38] and '*Rift Evolutionism*' [39], etc. I hope that scientists and engineers around the world will participate in this important study. Their joint efforts are urgently needed.

4.2. This study involves humans and animals

- Although this study involves ethical issues related to human beings, it is necessary and urgent.
- This study will span the entire duration of human existence in the future.
- Either humans will be destroyed or they will need to reform themselves bravely.
- We do not have much time to waste. Consider the melting of the polar ice caps caused by greenhouse gases and listen to the threats of nuclear war issued by warmongers.
- Not the entire human race, but a small number of space volunteers will participate in this research under the supervision of the Ethics Committee of the Global Scientific Community.
- Be brave and consider participating in this research, which will be the last great desperate attempt of our human race!

4.3. A discussion on Hawking's argument

Hawking's assertion that humans must increase their complexity[13] may be problematic in biology. The main reason that insects are more resistant to radiation than humans is that their bodies are less complex than ours.

In addition, some people think that if there is a nuclear war, the only animal that can survive on Earth would be cockroaches. That's because cockroach cells divide only once every seven days, whereas humans and other animals divide constantly. Because DNA is most vulnerable to radiation damage during cell division, cockroaches that were not dividing at the time of a nuclear explosion may have been more likely to survive. Additionally, their cells only reproduce every 48 hours and so the risk of mutation is lowered[40].

4.4. Ten exploring points

Scientists and engineers from all countries could pay attention to the following ten aspects:

- The spacecraft scale of exploring *Teegarden's Star b*[9]

It should be a giant flying saucer capable of accommodating 1,000 people and equipped with state-of-the-art facilities. Various technologies and approaches could be employed, such as

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constructing artificial habitats that can sustain human life in the long run and configuring EAST(Experimental Advanced Superconducting Tokamak)[41] to power the entire mission.

● Set up artificial sunlight inside the spacecraft to facilitate photosynthesis for plant-like astronauts with green skin.

● Proper disposal of deceased bodies on the giant flying saucer. Is it feasible to implement a space burial similar to a sailor's sea burial?

● The printing materials required for 3D printing equipment on the giant flying saucer can be singular or diversified.

● Medical check-ups for residents of the giant flying saucer.

● How to provide the necessary drinking water for residents of the giant flying saucer.

● The giant flying saucer's computer should use Musk's quantum computer.

● Is it possible to find a way to artificially produce hemocyanin in the human body, which may increase the transportation of oxygen in the blood?

● Can we reverse engineer or recreate skin breathing, taking us back to our embryonic stage?

● From a scientific and technological perspective, the proposals in this article pose ethical and scientific challenges. For example, cloning and manipulation, AI and synthetic biology technologies are at the forefront of scientific research, and ethical and moral issues need to be widely discussed. In addition, there are various problems associated with domesticating these cloned species and surviving on other planets, including environmental adaptability, biodiversity, and ecological balance.

4.5. The Anthropological classification of plant-like astronauts

If genetically modified corn belongs to the corn category, does a transgenic human, such as a plant-like astronaut, belong to the human category?

By definition, humans are organic beings with self-awareness, emotions, and cognitive abilities. Therefore, whether transgenic humans or plant-like astronauts possess these characteristics require scientific and ethical discussion.

As long as plant-like astronauts possess human consciousness, it does not matter whether they are even a hybrid of carbon-based and silicon-based life. They will be a continuation of humanity on exoplanets.

4.6. Eight unavoidable steps

The author proposed the following steps:

1. Creating plant-like organisms of various races on our Earth using AI and synthetic biology.

2. Cloning these plant-like organisms of various races on Earth (asexual reproduction), to increase their population size.

3. Providing modern education to these clones on Earth, utilizing Generative Pre-Training (ChatGPT) and brain-computer Interface (BCI) technologies.

4. Domesticating these clones in environments outside of Earth using AI and synthetic biology.

5. Facilitating interstellar reproduction between different domesticated astronauts (sexual reproduction) in environments outside of Earth to gain the evolutionary advantages of sexual reproduction[42,43] and prevent the fatal accumulation of harmful mutations in the clone body.

6. Cloning these interstellar new astronauts, who employ both asexual and sexual reproduction would increase the size of the excellent population.

7. In the giant flying saucer, new generations of "plant-like and cosmic-type" astronauts who are better suited for the interstellar environment, more resistant to premature aging, and capable of repairing shortened chromosomes[42,43] can be achieved through a repeated process of cloning, followed by mating, and then cloning again, creating successive generations of plant-like astronauts who can adapt to long interstellar expeditions will help address the challenge of human existence during interstellar exploration.

8. Sending plant-like astronauts, with both synthetic biology and cosmic expertise, to *Teegarden's Star b* - the closest potentially habitable exoplanet to us[9] - along with advanced scientific tools and

technologies, and a few super compressed compact discs (CDs) containing all of human civilization, and the DNA and genes of various animals and plants, bears the dreams of scientists and engineers around the world and holds the hopes of all the people...

5. CONCLUSION

There are two options currently facing humanity. The first is the Mars migration program led by Elon Reeve Musk, which would remain within the confines of solar system. The second option involves a more daring approach: the frantic escape of plant-like astronauts from the solar system, heading directly towards the first confirmed potentially habitable exoplanet Teegarden's Star b, located 12.5 light-years away. This approach is based on the eventual destruction of the solar system and the critical need for human survival.

The first option of colonizing Mars within solar system is both visible and realistic. It can serve as a crucial step towards eventually exploring and colonizing other parts of the universe. Though it may not help us escape the future burning of the Sun during its red giant, it can still offer invaluable insights and experience in interplanetary travel.

In contrast, the second option of the plant-like astronauts exploring and colonizing other parts of the universe falls short of this immediate practicality. It requires at least 231,000 years and extensive human modification. However, with "Voyager 1" having already paved the way, the possibility of achieving this feat in one go is not altogether impossible.

Both options have their own advantages and disadvantages. The Mars migration led by Elon Musk could provide a more immediate option for human continuation and expansion beyond Earth. However, it would still remain within the confines of the solar system, which may limit humanity's potential for long-term survival and exploration. On the other hand, the frantic escape to Teegarden's Star b offers a more extreme and risky option, but could potentially provide a greater chance for long-term survival and expansion beyond the solar system.

Ultimately, the choice depends on whether one prioritizes immediate survival or long-term survival. Should we consider both options simultaneously, much like how humans use their **two** legs to walk?

AUTHOR CONTRIBUTIONS: As the sole author of this study, I made substantial contributions to the conception of the study; I drafted and critically revised the paper for important intellectual content; and I approved the final version of this paper for publication.

FUNDING INFORMATION: No funding was received for this article.

COMPETING INTERESTS: The author declares no competing interests.

DATA AVAILABILITY: No data sets were generated or analyzed during the current study.

INCLUSION AND DIVERSITY: I support the inclusive, diverse, and equitable conduct of research.

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