

Prospective impact of human mission to Venus on the potential life in the Venus clouds and implications to human health

Grzegorz P Slowik¹, Anna Olewicz², *Aleksandra Zofia Stryjska³

1. Institute of Materials and Biomedical Engineering, University of Zielona Gora, Poland , 2. Department of Clinical Immunology, Poznan University of Medical Sciences, Poland , 3. Duke University, USA, Duke Kunshan University, China

Introduction

The proposed concept of human exploration of Venus includes crewed mission into the Venus atmosphere. The environment at 50 km from Venus surface has features such as pressure, gravity, radiation protection, and density comparable to Earth [1]. The results of spectral measurements of Venus suggest the potential presence of cloud-based microorganisms [2]. Moreover, terrestrial microorganisms that are present on the space vehicle and the bodies of the spaceship crew inevitably will come into contact with Venusian environment. Thus a question arises about implications of such interaction of the terrestrial microbes and putative extraterrestrial life.

Discussion

The presence of native life in Venus clouds can not be ruled out. Despite rigorous decontamination, microorganisms traveling from Earth to Venus on the bodies of astronauts, equipment and the space vehicle could interact with extraterrestrial environment and adapt to the new conditions. Microorganisms are known to be immensely resistant and adaptable, and can survive under extreme conditions of temperature, pH, radiation, or pressure. Furthermore, prokaryotes undergo extensive horizontal gene transfer and the transmission is more significant in species occupying the same ecological niche and is known to cross the interspecies barrier [3,4]. The mechanism could be responsible for irreversible change in the putative Venusian microbes. What is more, the results of a study by Zaccaria et al. showed the survival of investigated bacterial species to a range of simulated Martian conditions, including desiccation, UVC and polychromatic UV irradiation, growth in the presence of perchlorates, and exposure to Martian atmospheric composition and pressure [5]. In addition, the research by Domínguez-Andrés et al. revealed that human pathogenic microorganisms are able to adapt to limited resources and can alter their pathogenic capacity and the immunogenicity in response to the modified environment [6]. Thus, the consequences of terrestrial and extraterrestrial life interaction could not only significantly affect potential Venusian life but also endanger the health of the spaceship crew. Well-designed studies are necessary to employ appropriate countermeasures.

Conclusions

Future human missions to Venus should take into consideration the presence of the potential life in Venus clouds and take the measures necessary to avoid contamination of Venus atmosphere. Furthermore, studies are required that shed light on the impact of Venusian environment on the virulence and immunogenicity of terrestrial microbes.

References

[1] Taylor, F. W. et al. (2018) *Space Science Reviews* 214, 1-36. [2] Limaye, S. S. et al. (2018) *Astrobiology* 18 (9), 1181-1198. [3] Redondo-Salvo, S. et al. (2020) *Nature communications* 11 (1), 3602. [4] Koonin, E. V. (2016) *F1000Research* 5, 1805. [5] Zaccaria, T. et al. (2021) *Assessment of the adaptability of non-fastidious pathogenic bacteria to the Martian environment*. EANA, 7.-10. September 2021, Virtual

Conference. [6] Domínguez-Andrés, J. et al. (2020) *Astrobiology* 20, 1353-1362.

Keywords: Venus, human missions, microorganisms, immunology