SELECTED TERRESTRIAL MICROORGANISMS AS AN EXAMPLE OF POTENTIAL ANALOGUES OF VENUSIAN MICROORGANISMS. G. P. Slowik[1] and P. Dabrowski[2], [1]Institute of Materials and Biomedical Engineering, University of Zielona Gora, Poland (grzegslowik@o2.pl), [2]Division of Normal Anatomy, Department of Human Morphology and Embryology, Wroclaw Medical University, Wroclaw, Poland (pawel.dabrowski@umw.edu.pl).

Introduction: In the lower layer of Venus clouds (47.5-50.5 km above the planet's surface), due to the environmental conditions prevailing there, there might be microorganisms that are possible analogues of some selected terrestrial microorganisms [1,2]. In terms of research it is very important in experimental studies to select such bacteria and archaea that could potentially survive and proliferate in the atmosphere of Venus, which may be useful in solving the equation of life [3].

Aims: The aim of the study is to determine and identify selected terrestrial microorganisms that might be useful in experimental work on the potential survivability of unicellular organisms in laboratory reproduced physico-chemical conditions prevailing in the lower layer of Venus clouds.

Types of bacteria selected for experiments:

a) acidophilic bacteria. The environmental conditions in the lower layer of Venus' clouds, characterised by a very low pH, could be appropriate for microorganisms that are analogues of the earth bacteria of the species Acidithiobacillus ferroooxidans [1]. The metabolism of this bacterium, which can live and develop in anaerobic conditions, is based on such chemical compounds as: carbon dioxide - assimilated in the Calvin-Benson-Bassham cycle and nitrogen compounds [4], which are the main components of Venus's atmosphere. The bacterium Acidithiobacillus ferroooxidans breathes and gains energy by converting ferrous iron Fe^{2+} into ferric iron Fe^{3+}. The knowledge about the metabolism of Acidithiobacillus ferroooxidans is still being expanded [5].

b) electric bacteria. In hypothesis, where the lower layer of Venus' clouds is the giant bioaccumulator bacteria called exoelectrogens are considered as potential terrestrial analogues. They can generate electricity. The examples of electric bacteria are Geobacter sulfurreducens and Shewanella oneidensis [6]. There are also exoelectrogenic archaea, such as the hyperthermophile Pyrococcus furiosus [6] with an optimum growth temperature of 98 to 100°C [7], which can produce electricity at temperatures of 90°C [6]. Another exoelectrogenic, hyperthermophile archaea that produces electricity at high temperatures (80°C) [6] is Geoglobus ahangari with optimum growth temperature of 88°C [8]. Due to the high temperatures in the Venusian atmosphere and the phenomena of rapid decay of electric charges observed at an altitude of about 50 km above the surface of Venus [9], there is a need to use in experimental works, using substitutes for the Venusian atmosphere, bacterial strains whose ecological characteristics could correspond to those microorganisms potentially inhabiting Venus' clouds. The use of appropriate bacterial strains would allow the Venus cloud hypothesis to be tested as a giant bioaccumulator under the controlled conditions of a physical laboratory.

c) cable bacteria. Due to its unique physical properties, it is possible to conduct electric current over a distance of the order of centimeters. Only a decade ago, the discovered cable bacteria [10] could also be considered as possible analogues of potentially cloud-inhabiting microbes of Venus. It should be assumed that Venus analogues of terrestrial cable bacteria are capable of forming colonies, combining into very long (in terrestrial conditions such bioconductors may consist of up to 10,000 cells [11]) biocables which could also be responsible for the observed anomalies, such as disappearances of electric charge in the Venusian atmosphere [9]. The mechanisms of electron transport by cable bacteria are still intensively researched and are not yet fully explained [12]. Bacterial “wires” can be created by microorganisms, e.g. from the Desulfobulbaceae genus, but it has been shown that the electron transport mechanism occurs through nickel protein wires [12].

Summary: There are a number of terrestrial microorganisms that could potentially be analogues of Venus' unicellular organisms. They include, among others acidophilic bacteria, electric and cable bacteria. The aim of the work is to determine the usefulness for experimental studies of the survivability of microorganisms in the Venusian atmosphere of selected strains of unicellular organisms.

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