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SIMLE STARDUST: HOW AN EXPERIMENT EVOLVED FROM STUDENT TINKERING TO A  
STRATOSPHERIC RESEARCH PLATFORM**Abstract**

Stratospheric balloons are one of the most accessible methods of near space exploration. Their applications include capturing of extreme living organisms whose existence in the stratosphere has been suggested in the literature. These potential microorganisms would have evolved to survive the unique environment of low temperature, low pressure and high solar radiation. This makes development of near space platforms for microbial life search a demanding yet fascinating challenge.

Such investigations have been conducted by several research groups, with earliest instances in the 1930s. Since 2015, a student group based from SimLE Science Club at Gdańsk University of Technology has conducted several stratospheric balloon missions to survey the stratosphere for microorganisms under the project name “Stardust”. The gained experience from five iterations of the project ultimately resulted in the latest mission from Esrange Space Center in Sweden as part of the 13th cycle of the REXUS/BEXUS programme in 2021.

This approach improved existing research by developing a revised capture mechanism for microbiological material in the stratosphere as well as enhancing the method of post flight analysis of captured material.

To achieve this, we combined the methodology of classical microbiology with modern biotechnology. By seeding and keeping the captured microorganisms alive, we isolated and purified DNA. Subsequently, using MALDI-TOF mass spectrometry and Sanger sequencing, we led to taxonomic differentiation of the analyzed microorganisms. The results of our research testify to the effectiveness of the designed microorganism intake system, as well as the appropriately selected scientific methodology leading to the study and mapping of the diversity of microorganisms living in the stratosphere. Preliminary investigation of the data from the latest mission suggest that there might have been found new and yet undescribed strains of bacteria. Further research is required to examine the properties of the cultivable strains.

The stratosphere is an extreme environment for life, and future research, especially based on our approach, should expand our understanding of the diversity, distribution, and movement of microbes in the stratosphere.