



**CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY**

Name(s) Adam L. Wolf	Project Number J1339
Project Title Living in a Martian Atmosphere: First Steps towards the Terraforming of Mars	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective was to determine if specific microorganisms could meet two of the criteria (ability to survive in the Martian atmospheric mixture of gases, and the near vacuum atmospheric density) required to terraform Mars.</p> <p>Methods/Materials Four sets of each type of microorganism (a strict aerobe, a strict anaerobe, a facultative anaerobe, and yeast) were grown. Each set of four was placed in a different atmospheric condition, including the Martian atmospheric gas mixture, the Earth's atmosphere, a mixed atmosphere (which included proportions of O₂ and CO₂ between that of Earth and Mars), and a near vacuum that was comprised of the Martian atmosphere. After 72 hours in each atmospheric condition, the microorganisms were removed, and samples were plated and incubated to assess for growth. Any such growth was taken as evidence of survival.</p> <p>Results The anaerobic bacterium (<i>Clostridium sporogenes</i>) and the yeast (<i>Saccharomyces cerevisiae</i>) survived both in the Martian atmospheric gas mixture and in the near vacuum, as was evidenced by growth when they were replated on new agar and incubated in optimal conditions. In addition, it was noted that moisture and gas formation occurred while the microorganisms were maintained in the vacuum.</p> <p>Conclusions/Discussion Both yeast and strict anaerobes are candidates for survival on Mars since they demonstrated the potential for survival. Aside from their capacity to survive without O₂, their survivability is probably also due to their capacity to sustain themselves in harsh environments as spores and endospores respectively. Moreover, both are capable of releasing CO₂ as a function of their metabolism, which might result in the thickening of the Martian atmosphere, and hence the warming of surface temperatures and the melting of any ice that might exist.</p>	
Summary Statement This project investigates the capacity of four microorganisms to survive in a Martian atmosphere in order to assist in the terraforming of Mars.	
Help Received Dr. David Newcombe, and Dr. Karen Buxbaum both from the JPL confirmed that my choice of microorganisms was reasonable. Daniel Schoenholz, a research chemist confirmed that my design for the injection of gases was sound, and my mother helped obtain the apparatus and oversaw safety issues, and	