



**CALIFORNIA SCIENCE & ENGINEERING FAIR  
2018 PROJECT SUMMARY**

<b>Name(s)</b> Ayana R. Wilmot	<b>Project Number</b> <b>J1927</b>
<b>Project Title</b> <b>Factors Affecting the Rate of Photosynthesis of California Lichens: A Suitability Study into Producing Oxygen on Mars</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose is to see if lichen can photosynthesize in more Mars-like conditions than on Earth and identify which lichen species is best suited for producing Oxygen for humans to breathe on Mars.</p> <p><b>Methods/Materials</b> Materials: 4 different lichen species (Ramalina farinacea, Hypogymnia physodes, Flavopunctelia flaventior, and Xanthoparmelia taractica), LabQuest 2 data collection device, biochambers, Vernier O(2), CO(2) and pressure probes, Full Spectrum, Blue Enriched and Red Enriched LED light fixtures, digital balance, bell jar, light meter, thermometer and humidity detector.</p> <p>Light stands were built. Lichen samples were collected and massed. Data was obtained by placing lichen in biochambers and recording ppm CO(2) produced or utilized per hour per gram for each species in the following light conditions: None, Natural, Full Spectrum LED, Red Enriched LED, Blue Enriched LED. Light Intensity, Humidity, Pressure and Temperature were recorded. The rate of respiration (CO(2) production in the dark), rate of photosynthesis (rate of respiration minus rate of CO(2) production in a specific light condition), and net O(2) production (rate of CO(2) utilization in a specific light condition) were calculated. Control experiments were done with empty chambers.</p> <p><b>Results</b> All species photosynthesized in all four light conditions including low natural light (4,061 lux) with F. flaventior exhibiting the highest rate. It was also the only species that was consistently a net producer of oxygen under all experimental light conditions and under lower pressures. Photosynthesis was greatest with the Red and Blue Enriched LED lights. Photosynthetic rate was positively correlated with humidity (decreasing significantly from 66 ppm O(2)/h/g at 90% to 25 ppm O(2)/h/g at 67% to 2 ppm O(2)/h/g) and negatively correlated with time after collection.</p> <p><b>Conclusions/Discussion</b> Lichen can photosynthesize well in low and red-light conditions. F.flaventior or a similar species could produce Oxygen on Mars in suitable habitats to control temperature, humidity and pressure.</p>	
<b>Summary Statement</b> I found a lichen species (F. flaventior) that is a good net producer of Oxygen in low light, reddish light and low pressure but it needs a high level (>50%) of humidity.	
<b>Help Received</b> My dad showed me how to use the LabQuest 2 device and probes.	