



**CALIFORNIA STATE SCIENCE FAIR  
2009 PROJECT SUMMARY**

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<b>Project Title</b> Ear Protection and Noise-Induced Hearing Loss	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The objective of this project is to determine which ear protection device will provide the greatest noise reduction over different frequencies tested. I believe that Hearos earplugs will produce the greatest noise reduction because it has the highest NRR (noise reduction rating) of all brands tested.</p> <p><b>Methods/Materials</b> I selected five brands of earplugs for testing. I used a styrofoam mannequin head with holes drilled from ear to ear to hold an earplug on one side and a sound level meter on the other. An electronic keyboard was used to create three different sound frequencies. Multiple readings were taken and recorded for the control (without earplugs) and for each brand of earplugs at each frequency tested.</p> <p><b>Results</b> The results showed that Mack's earplugs produced the greatest sound reduction for all frequencies tested. It reduced decibel levels by 10.7% at the higher frequency, 3.6% at the middle frequency, and 6.1% at the lower frequency. Quiet Time finished second, with Hearos and Quiet!Please tied for third. EarPlanes finished in last place. The order of finish was the same across all three sound frequencies tested.</p> <p><b>Conclusions/Discussion</b> Mack's earplugs were the most effective at reducing sound levels at all frequencies tested. The data did not support my hypothesis because Hearos has the highest NRR but tied for third. My theory is that Mack's was the most effective because it formed a tighter seal and blocked more sound waves from entering the ear. These results may be different from testing on a human ear compared to styrofoam, which is more difficult to get a proper seal. Ear protection is important to consider in situations with excessive noise because noise-induced hearing loss can be permanent, but is also 100% preventable.</p>	
<b>Summary Statement</b> This project is to determine which ear protection device will produce the greatest sound reduction over different frequencies tested.	
<b>Help Received</b> Father drilled holes in styrofoam mannequin head and assisted me during the experiment; Mother helped with board set-up.	