



CALIFORNIA STATE SCIENCE FAIR  
2014 PROJECT SUMMARY

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<b>Project Title</b> <b>Crack of the Bat, Not Crack of the Skull! A Study of Pitcher's Protective Headgear</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b>          Head injuries are a serious issue in professional sports, especially in baseball. The pitcher is the most vulnerable position for injury, and Major League Baseball does not require pitchers to wear any protective gear. Standing 60 feet, 6 inches away from home plate, screaming line drives are hit at pitchers at up to speeds of 110 miles per hour. Injuries can include broken noses, ruptured eye sockets, and most importantly, concussions. In an attempt to find a remedy for this problem, we took protective materials that could act as hat liners, and tested how effective they were at protecting a pitcher's head.</p> <p><b>Methods/Materials</b>          We tested the hat liners in two different ways. In the first test, we took each liner, positioned it around the hat, and placed it over a melon. We then fired a pitching machine's pitch at the melon's front, back, and side, and measured the diameter and depth of each crater. Our linings included two hard hats, one with foam and one without, a kitchen bowl, football helmet padding, ice gel packs, Kevlar from a bullet proof vest, and for comparison, one with no protection. In our second test, we put each of the hat liners on a bowling ball, surrounded the ball with a sphygmomanometer (blood pressure cuff), and set it to 200 mmhg. We then dropped a 4.5 kilogram weight on the ball and observed the spike of the air pressure upon impact.</p> <p><b>Results</b>          In the impact damage experiment, the Kevlar only allowed a 1-centimeter wide and 1-centimeter thick crater when fired at from the back, and did not allow a crater from the front and side. No other lining came within a full centimeter in both measurements. In the pressure experiment, the football pads produced the best results, allowing 20 less mmhg than the second place finisher.</p> <p><b>Conclusions/Discussion</b>          We think that the Kevlar won the impact damage experiment because Kevlar is used in bulletproof vests, making a baseball at high speeds a cakewalk for the Kevlar. However, Kevlar is rather thin, and was not able to radiate out the pressure of a 4.5 kilogram weight as effective as the dense football padding in the pressure experiment. We learned through this experiment that strength protects against impact, but density protects against pressure. We suggest Major League Baseball get with the program, and require pitchers to wear a cap with a Kevlar padding lining. It would save injuries, careers, and even lives.</p>	
<b>Summary Statement</b> In order to prevent possible brain injuries, baseball pitchers should wear a padded Kevlar hat liner.	
<b>Help Received</b> Arcata Little League provided the pitching machine; George Cavinta provided the Kevlar	