



**CALIFORNIA STATE SCIENCE FAIR
2010 PROJECT SUMMARY**

Name(s) Cassandra E. Thompson	Project Number S1411
Project Title The Effect of the Height of a Jump on the Trajectory of a Jumping Horse; A Study of Equine Biomechanics	
Objectives/Goals When jumping a horse, the biomechanics that the horse executes vary as the height increases. This experiment explores what adjustments occur as the height of a jump increases.	
Abstract Methods/Materials The initial jumping part of the experiment occurred in an arena. It was documented with video and tape measures. The video information was edited into stills that were used to map the jump trajectories. Overlays were compared for each jump. The characteristics of the trajectory is best understood by analyzing it at key positions along the jump trajectories. Still images for each of the key positions over the 18 jumps was extracted and the 15 major axis of joints and spine connections of the horse's body were mapped through the trajectory. Using computer overlays, the trajectory of the various axis for each jump height were compared.	
Results 1) At the lower height jumps, the horse leaves the ground closer to the jump. 2) At higher jumps, the joint axis are spread out substantially more than for lower jumps. 3) At the 6" high and 12" high jumps, the fetlocks and hocks were about 1' from the jump, at the 18" and higher jumps the fetlocks and hocks started 3 to 4 times farther away from the jump. 4) The stifle, hip, sacrum and scapula stay relatively horizontal at the 6", 12" and 18" jumps, but rise higher and higher for the 24", 30" and 36" jumps. The horse can jump in stride at lower height jumps, but must break its stride to jump over 18". 5) The higher the jump, the lower the spine and head came down as the horse clears the jump. 6) The horse lands much farther away as the height is increased. 7) The hip and stifle lower for the high jumps. They lower slightly for the medium jumps. They remain level for the low jumps. The horse brings its center of gravity under it for higher jumps. 8) At the last full stride before the jump, the horse is typically the same distance from the jump regardless of the height; however, at the end of the jump, the horse is farther way as the height of the jump increases.	
Conclusions/Discussion A horse can clear modest jumps of 6", 12", and sometimes 18" without breaking its stride or changing the shape of its trajectory: however, the horse must change from a stride to a jump motion and alter the shape of its trajectory to clear jumps at 24" and above.	
Summary Statement This study of equine biomechanics explores the effect the height of a jump has on the trajectory and physiology of a jumping horse.	
Help Received Father taught me how to use image capturing and drafting software. Erin King, a professional horse trainer, rode the horse in the jump trials.	