

**“Monte Carlo Simulations of the Hill Dose Response Model”****Nicole Pranke, Perpich Center for Arts Education, Golden Valley, MN and Ashley Fry, Half Hollow Hills High School East, Dix Hills, NY -- 2004-05 National Team Finalists**

Abstract: The Monte Carlo method is a statistical tool incorporated into a variety of fields, ranging from economics to biology. Since its development as part of the Manhattan Project during World War II, Monte Carlo simulations have been used to illustrate real life error-containing scenarios. In our experiment, we performed Monte Carlo simulations for variations of the Hill Dose Response Model, a logistic formula used frequently to model the pharmacodynamic effect of drugs. In addition, we tested four weighting schemes, in which we weighted the data with the predicted, observed, or ideal  $y$  values, or simply did not weight at all. We also examined the effect of alterations in the  $x$ -data point design, number of replications of the design, and steepness of the Hill Model. These factors affect the accuracy and precision of the four parameters of the Hill Model:  $E_{max}$ ,  $D50$ ,  $m$ , and  $B$ . Our purpose is to determine which combination of specific factors results in producing parameter values (1) that are closest to our original ideal parameters, smallest bias, and (2) that have the smallest variance, greatest precision. We believe our approach will assist the successful development of new chemotherapeutic drug combinations against cancer and other diseases.