



**CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY**

Name(s) Gautam V. Prabhu	Project Number S0824
Project Title Kinetic Modeling of Signal Transduction in the Intra-S Phase DNA Damage Checkpoint	
Abstract Objectives/Goals The objective is to create a kinetic model of the Intra-S Phase DNA Damage Checkpoint, which is important in cancer, in order to better understand its inner workings. Methods/Materials Ordinary differential equation (ODE) modeling was used to model the reaction network using mass action chemical kinetics. Rate constants were inferred from models of other checkpoints or derived from experimental data in other publications. Using the model, knockout and sensitivity analysis simulations were executed in MATLAB to learn more about which proteins and reactions are most critical to the system. Results The model, validated through comparison to experimental results from other publications, shows that one of two parallel paths in the checkpoint is dominant. Additionally, crosstalk between the two paths is negligible in wild-type cells. Since the model is a valid predictor of experimental results, researchers in the field can use the model to run experiments in code before lab experiments to get a quick estimate of the results. Conclusions/Discussion The model's simulations accurately (within around 10%) replicate the results of experiments from the literature. The idea that one parallel path is dominant implies that diseases that damage the dominant path are much more likely to cause complications such as cancer. Since crosstalk negligible in wild-type cells, it is likely heavily favored in non-wild type cells in which one path is knocked out.	
Summary Statement I designed a model using chemical kinetics that helps researchers better understand the intra-S phase DNA damage checkpoint, which is important in cancer.	
Help Received None. I researched, programmed, and analyzed the model myself. My advanced science research teacher provided a space to work, help with scheduling, and general advice.	