



**CALIFORNIA STATE SCIENCE FAIR  
2002 PROJECT SUMMARY**

<b>Name(s)</b> Charles C. Ciongoli, III	<b>Project Number</b> <b>S1206</b>
<b>Project Title</b> <b>Chaos in the Brain: A Simulation of Coupled Differential Equations</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The goal of this project was to effectively and numerically solve coupled differential equations that display chaotic behavior in a computer program. The differential equations modeled the system dynamics of neural firings inside of a human brain.</p> <p><b>Methods/Materials</b> In order to complete this project, the researcher had to first acquire the programming skill that would be needed in order to write the computer project. The program was written in a language known as #Scheme.# Scheme is a function based language meaning that functions can be passed as parameters. Also the researcher had to learn ways of finding the derivative (slope of a function), integration (area under a function), and numerical methods to solve the differential equations.</p> <p><b>Results</b> The written computer program returned a graph of the functions. It showed phase trajectories moving towards either of two points.</p> <p><b>Conclusions/Discussion</b> It is concluded that it is indeed possible to write a computer program to numerically solve coupled differential equations that display chaotic behavior. Two points of attraction, or places where there is stability, were found on the graph. However, a limit cycle was wanted in return rather than the points of attraction. The parameters used must have not been correct in order to form the limit cycle. Another program will be written to explore the possibilities for all of the parameters.</p>	
<b>Summary Statement</b> This project is a computer program that models the chaotic behavior in a neural population by solving coupled differential equations.	
<b>Help Received</b> Biology Teacher helped proofread report; Computer Teacher taught advanced math and programming skills; Mother and Father proofread report and helped with backboard.	