



# CALIFORNIA STATE SCIENCE FAIR 2007 PROJECT SUMMARY

<b>Name(s)</b> <b>Amy T. Bellinghiere</b>	<b>Project Number</b> <b>J0804</b>
<b>Project Title</b> <b>Fire on the Electrical Neuron</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> To build an electrical circuit model of an integrate-and-fire neuron, and test its function: More specifically, to find out how integrate-and-fire neurons work, how to construct simple electrical circuits, measure voltage and current, and how to change the operations of the circuit. I also wanted to find out if this circuit could improve the processing speed of robots, computers, and other electronics.</p> <p><b>Methods/Materials</b> First I researched and learned about integrate-and-fire neurons. Then I learned about electricity and basic circuit components. Then I constructed a circuit model of an integrate-and-fire neuron. I did some basic measurements on the model, like voltage across the integrating capacitors, and current through it.</p> <p>The materials I used: 1 Maxitonix Electronics Lab with wires, 6 AA batteries, 1 4.7K, 1 10K, 1 47K, 1 100K, 1 220K, 1 470K resistors, 1 relay, 1 meter, 2 NPN Transistors, 2 100uF capacitors, 2 10uF Capacitors 1 switch, 2 light emitting diodes, wires, a voltage regulator, a millisecond timer, and a voltage meter</p> <p><b>Results</b> My results have been that I have a working electronic circuit model of an integrate-and-fire neuron. Through measurements I verified the proper operation of this model. I also managed to change the firing time of the neuron model. For example, when I decreased the value of the input resistor the firing time reduced, and when I increased the value of the input resistor the firing time became longer.</p> <p><b>Conclusions/Discussion</b> My conclusion is yes, I have an electrical circuit model of an integrate-and-fire neuron. The firing rate and charging rate, of the model can be controlled, by adjusting the input resistor on the circuit. It can collect and release charges like a neuron can with chemicals. I can also slow down or speed up the input like a neuron. I would like to have more different amounts of input resistance next time. Also I would like to have a circuit board dedicated to just that circuit.</p> <p>I would like to build a duplicate circuit and connect the two together to show basic processing. I would like to learn about the mathematical models of this type of circuits and develop some of my own. I would also like to figure out how this type of processor is applicable for robots, such as with their decision-making and sensing.</p>	
<b>Summary Statement</b> I wanted to learn about artificial intelligence so I built an electrical circuit model of a integrate-and-fire neuron and tested its function.	
<b>Help Received</b> Dr. Peter Petre helped me explore the new world of electronics by supplying textbooks, mentoring and supervision; Dr. Brian Limkatkai designed the circuit that I built on the Electronics Lab; My 7th grade brother helped me with computer problems; My Parents helped with proofreading and typing.	