



**CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY**

Name(s) Thomas W. Moulia	Project Number S1211
Project Title Cardiac Measurement and Analysis	
Objectives/Goals Purpose of the Experiment: The goal of this project was to develop an expert system to screen for cardiac anomalies. The specific objectives were to 1) construct an electrocardiograph 2) create an expert system which will differentiate among different heart anomalies and 3) record and accurately analyze cardiac waveforms.	
Abstract Methods/Materials Methods: A one channel ECG was constructed to measure cardiac electric potential. Data was digitized using an analog to digital converter. An expert system was created using Java. It was designed to identify heart potential waveforms by using a set of trained neural networks. The training was based on digitized heart anomaly waveforms available over the WEB from MIT/BIH. In addition variants of these neural networks were designed to find distinct segments (P, QRS, PR complexes) of the cardiac waveform, allowing analysis of waveform features (peaks, duration and sequence). Actual ECGs were taken and analyzed for a number of subjects.	
Results Results/Conclusions: Initial attempts were made to train the system to recognize entire beats of various anomalies. Because of significant waveform variation even within a particular anomaly, this approach was abandoned in favor of training the networks to recognize various waveform complexes within each beat and then using their shape, duration and relative timing to diagnose anomalies. On this basis the system was able to distinguish a limited set of heart anomalies discernable on a single modified lead 2 channel with a high rate of success. These anomalies included tachycardias, bradycardias, escape and premature beats, and 1 deg AV and bundle blocks.	
Summary Statement Built an electrocardiograph and developed expert system software to diagnose heart anomalies.	
Help Received Ms Helms (teacher) advised on software issues, mother helped with board, father helped edit text	