



**CALIFORNIA STATE SCIENCE FAIR
2005 PROJECT SUMMARY**

Name(s) Miriam C. Glicksberg	Project Number S1006
Project Title Do the Right and Left Ears Hear Notes Differently in Atonal Individuals?	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals Relative pitch, the ability to sing in tune, relies on hearing notes correctly, measuring their intervals, storing the information in memory, and producing the tones. I am trying to understand what leads to atonality, the inability to carry a tune. It is possible that the Atonal individual does not hear notes correctly or even that the two ears hear conflicting notes. In this case, one ear could be dominant, or the resulting sound could be a blend of what the individual ears hear. By testing the ears separately and together in a tone matching test, I can discover whether Atonal individuals have a defect in one or both ears that affects how they sing.</p> <p>Methods/Materials I obtained informed consent from 62 participants, including 25 males and 37 females, ranging in age from 13 to 76 years. I collected information, including handedness, musical training, self-evaluation of singing ability, eye dominance, and hair whorl direction. I measured relative pitch capability with a chromatic tuner while subjects sang a simple melody (measuring 10 notes x 3 replicas). Next, I tested their tone matching ability using a test CD played with a splitter jack, so that the earphones could play the tones for individual ears or both at once. I again measured their vocalized tones (5 notes x 3 replicas x 3 sets). Notes were converted into numbers and graphed to determine phenotypes.</p> <p>Results Most Atonal subjects scored poorly in tone matching. Surprisingly, however, more than one third had excellent scores in the Tone Matching Test. This means that hearing tones well is not enough to carry a tune. Left and right ears differed in more than one third of the participants, mostly in those with poor tone matching ability. I found ear dominance in approximately 30% (7 of 24) of those with poor tone matching ability, but in less than 10% of those with excellent tone matching skill. The sidedness of ear dominance (left vs. right) did not correlate with hair whorl, eye dominance, or hand dominance.</p> <p>Conclusions/Discussion My hypothesis is partially correct. Hearing conflicts and ear dominance may influence the perceived tone in a significant portion of Atonal individuals. Since more than one third of the Atonal subjects have excellent tonal hearing, I conclude that tone matching and interval measuring are independent skills.</p>	
Summary Statement I discovered that there is often an apparent difference in what the right and left ears hear in Atonal individuals.	
Help Received I thank my participants, my Science Fair advisor for providing a testing room at school, my parents for driving me to participants' homes, my mother for help with typing and teaching me how to use Microsoft Excel, my brother for help with the randomizer program, and my family for useful discussions.	